Vol. 25, No. 3 PSYCHOLOGICAL REVIEW PUBLICATIONS May, 1918

Psychological Review

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PUBLISHED BI-MONTHLY BY
PSYCHOLOGICAL REVIEW COMPANY
41 NORTH QUEEN ST., LANCASTER, PA.
AND PRINCETON, N. J.

Entered as second-class matter July 13, 1897, at the post-office at Lancaster, Pa., under Act of Congress of March 3, 1879

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PSYCHOLOGICAL REVIEW COMPANY
Princeton, New Jersey

FOREIGN AGENTS: G. E. STECHERT & CO., London (2 Star Yard, Cary St., W. C.); Leipzig (Koenigstr., 37); Paris (16, rue de Condé)

VOL. 25. NO. 3 May, 1918

THE PSYCHOLOGICAL REVIEW

THE PRESUPPOSITIONS OF A BEHAVIORIST PSYCHOLOGY

BY H. HEATH BAWDEN

Carmel-by-the-Sea, California

I. THE NATURAL-SCIENCE VIEW OF MIND

The popular idea of the soul is one which has been handed down to us from a time when it was believed that there were two different worlds. The one of these worlds was the world of external nature in which our bodies are born and grow and become old and die like the other animals and plants. This was called the physical or material world, the world of matter, and the body was regarded as a material object which had a beginning and an end. The soul, on the other hand, was conceived as belonging to the world of mind—the spiritual or mental or psychical world. And, in spite of the obvious facts of mental growth and decay, this spiritual part of our nature was supposed to be independent of death, indestructible and immortal. Some thought a new soul began with the beginning of each new body in the mother's womb, others that souls are eternal, appearing in different bodies at different times—reincarnations.

It is never wise to dogmatize about such matters, for the truth usually lies somewhere between the extremes of opinion. But there is one phase of the question we must not lose sight of: science is continually adding to the evidence which goes to show that there are no sharp separations in nature. Science encourages a belief in the unity of man with the rest of nature and the identification of all the forces of the universe in a single principle. Whether this principle shall be called

material or spiritual seems of less importance than the fact of the unity of all things to make a universe. Accordingly, the man of science insists, not only on the facts of the soul-life or mind, but on their interpretation in consonance with the rest of the laws of nature.

This leads him to demand evidence for any affirmation that is made with reference to the soul and to relegate to the realm of unproved hypotheses all views which have no basis except the desires and feelings of men. Such desires and feelings he admits are very real facts in the world, but so are illusions and superstitions and errors of all sorts. Just because he has faith in the ultimate triumph of truth the man of science demands that beliefs shall submit to the most rigorous tests. As a consequence, the idea of the soul is undergoing a profound transformation at the hands of the man who understands the meaning of scientific method.

The new idea is so different from the traditional one that to many it seems as if it were not soul at all. That science has thrown over a certain conception of the nature of the soul is certainly true, just as it has thrown over the belief that the earth is flat and that insanity is due to evil spirits. But that science has denied a place in the system of the universe to the facts represented by the word soul is not true. On the contrary there never has been so marked an advance in the field of mental science as during the past fifty years. The science of psychology has taken its place among the exact sciences.

The language in which the facts of mental life are described has undergone a profound change, so that those who have not been following the development of psychological investigation are apt to think there is no place left for the beliefs they hold. And perhaps there isn't if those beliefs are not grounded in experience. The man who believes that the earth is flat finds the modern sciences of physics and astronomy against him. The most the scientist can grant him is that the earth looks flat, and his belief is relegated to the realm of sense illusions. The scientist does not deny the appearance of flatness, but he commends the man who

holds this belief to that department of science in which such deceptive appearances are explained.

So in the case of the mental life or soul. If in the course of a more accurate observation of the facts of the soul life the duality of mind and body disappears as the flatness of the earth vanished before a deeper grasp of celestial mechanics, it must not be inferred on that account that the essential facts of the mental life have been denied. Indeed, the more psychological investigation discloses the nature of our psychophysical life, the more marvelous such behavior becomes, until, in the minds of many students of these phenomena, it seems as if psychology had become the key to all the other sciences. Every fresh scientific inquiry feels this interdependence of its point of view with the whole system of organized knowledge.

In its first ambitious advances the young science was called by its critics the psychology without a soul. But this was a mistake. The word soul was no longer prominent in its nomenclature just as the word life was gradually dropped from the pages of biology, but the essence of the matter was there. The mental is now given a place in the system of things it never had before because it is being organized now for the first time into the very body of scientific method. It has become a principle informing all facts, whereas before it was conceived as a separate field sufficient unto itself.

Just as we have given up the primitive ghost or demon in the mountain and stream and tree, and as an explanation of insanity, just as we have given up the ghostlike essence called caloricity in the phenomena of heat, and as we are slowly sloughing off the idea of vital force in biology, so we must give up soul or mind or consciousness or ego or self, as distinct from a certain kind of behavior, in psychology. If it is irrational to postulate electricity in an electromotor or magnetism in a magnet except as an abbreviated description of the facts, it is likewise irrational to postulate a mind-force in a certain other kind of machine called an organism. We have achieved the impersonal point of view in the interpretation of stars and stones and trees and bacteria and frogs and guinea-pigs.

Our next step is to achieve it for the phenomena of human behavior. With this achievement will fall away the whole dialectic superstructure of epistemological dualities and entities which have lingered to confuse scientific method.

2. The Concept of Behavior

We humans are objects in space and time behaving in certain ways. In one aspect we are just *things* in a world of things, including stones and stars and atoms and electrons. We are different from other things: less like stones and apples than we are like whales and monkeys. We classify ourselves in the group called animals, mammals, primates, because we behave more like members of this group than any other.

For this reason we more narrowly define ourselves as *organisms*, and, among living things, as belonging to the group of animals rather than plants. We classify ourselves among organisms because organisms behave in a different way from mechanisms which we associate rather with the behavior of things. It may be, indeed, that an organism is only a more delicately constructed machine. In fact this is the assumption of exact science today. But there is such a marked difference of degree of adaptability between a living and a mechanical structure that we are justified, for practical purposes, at any rate, in describing the behavior of organisms as a distinct type.

But even this does not complete the account. We behave, not merely as things and as organisms, but as *persons*. Among living creatures there is a smaller or larger group that behaves in a characteristic way which leads us to speak of them as selves and, from certain points of view, we then ascribe to these creatures certain traits or capacities which we express by the terms mind, soul, spirit, consciousness, feeling, sensation, perception, memory, imagination, judgment, reason. These peculiarities of behavior may, indeed, be latent even in atoms and stones and stars. But, again, the difference of degree is so important—granting that it is only a difference of degree, which is the opinion of many men of

science—that we feel justified in describing the acts of persons as a distinct type of behavior.

Here, obviously, is a rich field of fact and a confusing wealth of theory. For we have set before us in this simple account some of the deepest problems of nature and of man. What is the true significance of these differences: between the unorganized and the organic, between the organic and the conscious? Do these types of behavior represent ultimate differences or simply different stages through which everything passes, sooner or later, in its evolution from the simple to the complex?

It is easy to slip into the fallacy of seeming to explain difficult points by accepting uncritically from the past hard and fast categories like mind and matter, subject and object, individual and society. Restricting our view to the natural history of behavior, and proceeding by the method of scientific observation and explanation, we are not justified in beginning our inquiry with any such fixed class-names. If these categories represent real differences this must be disclosed in the course of our study; we may not beg the question by assuming them at the start.

For the same reason we must be alert to the fallacy that lurks in the contrast of inner and outer, especially as contained in the concept of introspection which has been supposed to be the exclusive method of psychology. A natural history of behavior cannot recognize any special prerogative unless the facts clearly demand it. That mental behavior is of a distinct order, to be approached by a special method, is a point to be proved, not to be assumed.

And the same possibility of fallacy lies in the contrast between the individual and the social. Not that such a distinction has no meaning, but that the precise nature of the meaning remains to be made out; it comes properly at the conclusion of our inquiry rather than at its beginning.

For some time, in the field of scientific method, the need has been urged of a category common to the physiologist and the psychologist in terms of which the problems of bodily and mental function might be discussed without arousing

metaphysical prejudices. Such a category is action or behavior. The former is perhaps the more abstract concept, lending itself more readily to the discussion of the philosophical questions involved. The latter has the advantage of being a term of popular as well as scientific usage in describing the action of organisms. Books are appearing with the title or sub-title of Behavior, and under this term the authors are successful for the most part in discussing the activities of organisms without prejudging the question of the nature of the psychical and its relation to the physical. The behavior of microörganisms is being investigated in terms of action-systems in a way which does not preëmpt the field for either a mechanistic or a teleological interpretation of the facts.

It is too early in the history of the new point of view to predict the lines along which the two sciences will get together, but it is safe to say that there will have to be considerable revision of working concepts on the part of both the physical and the psychological branches of science. By this is meant that the recent insight into the energic nature of matter will in time inevitably affect the biologist's conception of the nature of what he calls an organism. Biology, in so far as it claims to be an exact science, regards the body as a complicated mechanism whose elements are to be understood in terms of the chemical and physical laws which hold for these elements outside the organism. So that if, for example, the study of the electrical properties of matter results in transforming our chemical and physical notions, and some form of an energic is substituted for the atomic theory, this dynamic view ultimately must reach into biology with transforming effect. In a similar way the conception of the nature of mind is undergoing reconstruction in psychological science, in part due to this same energistic theory which is transforming physical science.

The development of a congruous method for physiology and psychology will probably take place very slowly, however, because of the diverse historical conditions and techniques associated with the two sciences. Biology had its roots in the natural and positive sciences; psychology arose

as a branch of metaphysics and was long known as mental philosophy. But now that the basis has been laid for a scientific psychology, there is hope of its being possible for the psychologist and neurologist to get together in their work on the common problem. As has been intimated, this will involve a revision of psychological conceptions on many fundamental points. That this is already taking place is evident from recent tendencies in psychological thought. Consciousness is coming to be stated more and more in terms of action, in terms of the motor aspect of the organic circuit instead of in terms of the sensory aspect which was the tendency with the older writers. Great emphasis is now being placed on the motor character of attention, on the dynamogenic nature of ideas, on ideomotor impulses, the tactile-kinæsthetic imagery as the carrier of meaning, on emotions as the vestiges of motor attitudes, on the growth of voluntary movement, and on the reconstructive function of thought. It is coming to be recognized that the distinctions between reflex and instinctive activities are not fundamental, and that the sharp line drawn between instinct and intelligence will fade away before a more adequate analysis. Perception is defined as an attitude toward the object perceived, a reverberation within the sensorium, not merely of the present stimulation, but of stimulations in the past preserved by the chemical retentiveness of the tissues. As Alfred H. Lloyd has said, "Nothing is so much needed at the present time as the adjustment of the science of abstract thought to the science of organic action, and every little hint as to how this adjustment can be brought about cannot but be at least a little help. The evolution of consciousness must be almost meaningless until the simplest case of accommodation as seen by the biologist is identified with the most perfect case of abstract thought that the logician knows." [1]

3. The Concept of Introspection

One of the leading problems which has agitated psychology on the side of method has been the question of how it obtains

[1] Psychol. Rev., 1896, 3, 426.

its data. Springing, as it did, chiefly from philosophy, the new science naturally carried over into its procedure certain assumptions which upon subsequent examination have proved more than doubtful. One of these, as we have seen, is the assumption of the existence of two orders of reality, the physical and the psychical. This, under analysis, has been refined to a mere concomitance of phenomena or, indeed, in the view of an increasing number of writers, has completely evaporated as a valid distinction. As long as some form of psychophysical parallelism prevailed, whether a true parallelism of different orders of existence or a mere parallelism of manifestation, it was inevitable that psychological method should be affected thereby. This influence has shown itself most in what is known as the doctrine of introspection.

This doctrine, until quite recently, has been held to be the distinctive characteristic of the science. Psychology has been supposed to derive its subject-matter from a different source and by a different method from the other sciences. The data of all other sciences are discovered by direct inspection of facts in the objective world of space and time, *i. e.*, by *extro*spection. Psychology, on the other hand, was the one science which was supposed to find its facts by *intro*spection, *i. e.*, by an inside view of this second order or aspect of reality called the psychical or mental.

If, however, the grounds for postulating the existence of more than one order of reality are questionable, it follows that the presumption is against this uniqueness in the nature of the data and methods of psychological science. If we stick closely to the concrete facts of the universe as we find it outside and inside our organisms, it appears that all we are entitled to say is that while certain facts are equally ascertainable by all observers, certain other facts, namely those within the organism of each individual, are more easily ascertainable by the individual concerned than by outside observers. But this ease of access, because of nearness to the facts, is not a sufficient ground for characterizing such observation as a unique method or the data thus secured as differing in kind from other data secured by the objective method.

What we observe in so-called introspection is usually but the inner bodily beginnings, hidden from outer view, of the same behavior which in its outer overt manifestations is described by external observation. This obviously is merely a difference of accessibility of the facts, not a difference in their nature. A nascent response is just as truly an objective datum as the completed performance.

All data of science are data of individual inspection in a sense. Every scientific inquiry begins in some individual's experience and proceeds by an examination which is sustained by the interest and purposes of that individual inquirer. Not even in the most rigidly experimental method is it possible absolutely to exclude or control the personal equation. The individual's outlook upon the universe inevitably colors the descriptions he gives and the conclusions he draws. The greater part of scientific technique is just for the purpose of checking up results in terms of such factors, and we speak of the results of an inquiry as scientific just to the degree that we succeed in reducing this personal element to a negligible quantity.

We may go even further and admit that all the information I derive by what is called external observation—for example, by the use of the distance-receptors, the eye, the ear, and the nose—must be translated into terms of that more immediate information that I derive from my own inner bodily processes—derived, in this case, through end-organs in muscles and viscera and semicircular canals. But this means merely that the somatic organs of discrimination are genetically older than the cephalic distance-receptors, and therefore are the primary carriers of the meaning of the situation, not that the facts ascertained in the latter case belong to a different category. It is the same sort of situation as when, with an imperfect knowledge of a foreign language, I find that I must first translate the unfamiliar symbols into terms of the mother-tongue.

The root of the matter is here. It see that you behave in a certain way that resembles the way I behave when I am in pain. In the same way I infer that you have many other

experiences. With somewhat more difficulty, if I were blind, I might make the same inference from the tone of your voice; or if I had the nose of the dog I might make the inference by the sense of smell. If my only knowledge of your behavior were through the senses of touch and movement, I could know your behavior only as I, so to speak, participated in it—acted with your acts and sympathetically pulsated with your attitudes. Helen Keller secures an approximation to this through the refinement of her tactile and kinesthetic senses in the use of the manual alphabet, placing her fingers on the speaker's lips, passing them over a surface to explore its meaning, etc. Ultimately I could know your behavior only as I entered into the experience you are having, only as my nervous system were commissured into yours. If for seeing could be substituted touching and particularly hefting, pressing and other kinesthetic experiences, the distinction of inner and outer implied in the so-called introspective method would not exist. In other words, if the intro*spect*ive were reinterpreted in terms of an intro*tact*ive method, vision in terms of touch and movement, the supposed difference between the two kinds of data would disappear.

That this is true is shown by the fact that we do not as readily ascribe consciousness to the ant or to the oyster or to the tree as we do to the dog or the horse or the man. We cannot participate in the experiences of these creatures in terms of mandibles and tentacles and waving leaves and swelling root-hairs as we can in the case of creatures with behaving organs more like our own. The problem vanishes to the degree that we put ourselves into the attitudes common to these lower forms and seek to describe and explain behavior in terms of contacts and movements. If we could quiver with the jelly-fish intimately enough really to know its behavior, we should simply be describing our common experience, as we already do in our objective sciences of the phenomena of the external world. There would be no problem of introspection and inference to other consciousness, no problem of inner and outer, no problem of mind and matter, no problem of unshareable individual consciousness on the one hand and shareable social experience on the other.

It is possible, of course, to have a science of individually observed facts only on the assumption that they are typical phenomena, *i. e.*, phenomena similar to what other similarly situated individuals observe. Science is the statement of observed uniformity (universals) among particulars. But there is no problem here which is not encountered everywhere in science: it is just as true that no two blades of grass or grains of sand are precisely alike as it is that no two psychological facts are alike. The data derived from the individual's observation require to be checked by the data derived from observation by other individuals here just as they do elsewhere. The scientific standpoint is always the standpoint of the observer, the third person's point of view. The first person's point of view is as important and valuable as one pleases; it may be largely determinative of behavior: but it is not science. Inside facts must first be made outside before they acquire the status of scientific data. This is commonly expressed by saying that the standpoint of science is objective, experimental, and mathematically exact. No merely particular, private, individual fact has any scientific value save as a point of departure for research.

4. Current Conceptions of the Mental

Various attempts have been made in recent years to formulate a definition of mind from the natural-science point of view.

The one which has aroused the most discussion is known as the Relational Theory of Consciousness, first formulated by Woodbridge. According to this view consciousness (and by implication mind, which in this discussion is not distinguished from consciousness) is not a substance, nor an attribute of a substance, but a relation. "Consciousness is the result of the interaction between the organism and its surroundings. . . ." In the sense organs and central coördinating mechanism we find the two characters of consciousness—its diversity and its unity. "An organism so situated that it should be in differentiated interaction with the specific differences in the world about it, but which should, none the

less, react in a unified and coördinated manner no matter how it might be stimulated, might well be defined as a conscious organism. Its consciousness would be a relational system integrating and unifying its differentiated interaction with its surroundings. Furthermore, its consciousness would naturally be marked by many of the characteristics usually attributed to consciousness. It would, for instance, be what we call individual and personal, and, being unified, it would present features often ascribed to a self or mind." [1]

Similarly Montague says: "If consciousness is at length to submit to the same scientific treatment that we accord to other phenomena, *i. e.*, if it is to be equated to a mode of relation between things—it must inevitably be regarded as secondary to those things." Consciousness is a 'mode of connection between the organism and its environment.' [1] Consciousness is 'a relation existing in a material nature along with other relations of space and time.' [2]

Singer says that the mind or soul must go into the same methodological oblivion that has already received the entities once supposed to exist under the names of caloricity and vital force. "Life is no longer a thing to be inferred from behavior; it is behavior. . . . Disembodied life has been placed among the myths." [3] "Consciousness is not something inferred from behavior; it is behavior. Or, more accurately, our belief in consciousness is an expectation of probable behavior based on an observation of actual behavior, a belief to be confirmed or refuted by more observation, as any other belief in a fact is to be tried out." [4] "I don't know what life means nor what consciousness means," but "neither stands for an eject forever veiled and hidden in the land beyond experience. . . . I regard my own mind as behavior quite as frankly as I take my fellow's mind to be nothing else." [5]

[1] *J. of Phil., Psychol., &c.*, 6, 449–450.
[1] *Ibid.*, 2, 313–314.
[2] *Ibid.*, 4, p. 377.
[3] *Ibid.*, 8, p. 186.
[4] *Ibid.*, p. 183.
[5] *Ibid.*, p. 184.

According to Hollingworth "all sciences are studies of behavior." Psychology is the 'science of behavior of statistically variable experience.' [1] "The physical world, with which the physical sciences deal, and for which are developed the various shorthand symbols by which we designate the objects as independent of experience, consists of those experiences which are statistically common. The independence of these objects, their stubbornness, their resistance, their objectivity and naturalness, these all are not unique characteristics which suffice to split experience in two, they are merely various and interesting ways of stating the same statistical fact. The dependence, the subjectivity, the personal character of other experiences, the so-called mental order, are merely literary terms which express their statistical limitations and their consequent vagueness and complex conditions of appearance." [2]

Bode (in 'Creative Intelligence,' by Dewey and Others, in the chapter entitled 'Consciousness and Psychology,' pp. 244–255) says that consciousness is 'a name for the control of conduct by future results or consequences.' It is 'just a future adaptation that has been set to work so as to bring about its own realization.' "Conscious behavior, as contrasted with the mechanical character of the reflexes, is essentially experimental. . . . All experience is a kind of intelligence, a control of present behavior with reference to future adjustment. To be in experience at all is to have the future operate in the present. . . . It is this relationship of present response to the response of the next moment that constitutes the distinctive trait of conscious behavior. The relatively unorganized responses of the present moment, in becoming reflected in the experienced object, reveal their outcome or meaning before they become overt, and thus provide the conditions of intelligent action. In other words, future consequences become transformed into a stimulus for further behavior. . . . If it be granted that consciousness is just a name for behavior that is guided by the results of acts

[1] *Ibid.*, **13**, p. 187.
[2] *Ibid.*, p. 186.

not yet performed but reflected beforehand in the objects of experience, it follows that this behavior is the peculiar subject-matter of psychology. . . . A quality, such as 'sharp' or 'hot,' is not mental or constituted by consciousness, but the function of the quality in giving direction to behavior through certain changes which it undergoes *is* consciousness. . . . Psychology, therefore, is properly a study of the conditions which determine the change or development of stimuli; more specifically, it is a study of the conditions which govern such processes as those by which problems are solved, lessons are memorized, habits and attitudes are built up, and decisions are reached."

Sellars says: "Consciousness is a variant and seems to have meaning only in an organism's stress relations to its environment." [1]

Perry says: "Mind *is* behavior, or conduct, *together with* the objects which these employ and isolate. . . . A mind embraces certain objects, or parts of the environment, with which it deals in its own behalf." [2]

Dewey says the mental is the fragmentary character or aspect of the real. "Any given set of facts of which there is an idea is not yet fully real in itself. . . ." That is, the mental, consciousness, sensations, ideas, are reality demanding completion or, at least, transformation into something else. "It demands precisely its own further requalification." [3]

"Where, and in so far as, there are unquestioned objects, there is no 'consciousness.' There are just things in their factual relations. When there is uncertainty, there are dubious suspected objects; things hinted at, guessed at. Such objects have a distinct status, and it is the part of good sense to give them, as occupying that status, a distinct caption. 'Consciousness' is a term often used for this purpose." [4] The only reason we come to regard ideas as private and personal is that in most biological adjustments these dubious suspected aspects are more apt to fall within

[1] *Ibid.*, 5, p. 238.
[2] *Ibid.*, 6, p. 175.
[3] *Ibid.*, 4, p. 257.
[4] *Ibid.*, 5, p. 375.

the organism itself or those which do so fall are emphasized since they serve not only to present the problematic character of the situation but supply also the instruments for its reconstruction. These partial aspects, in the absence of the ability to serve as factual realities themselves, come, as symbols, to stand for other realities; that is, they become ideal realities, ideas. "So treated they are tentative, dubious but experimental, anticipations of an object." These 'intra-organic events' thus are 'inchoate future cosmic objects in process of empirical construction.'[1] "Ideas, sensations, mental states, are, in their cognitive significance, media of so adjusting things to one another, that they *become* representative of one another. When this is accomplished, they drop out; and things are present to the agent in the most naïvely realistic fashion."[2]

5. The Distinguishing Marks of the Mental

If we proceed with mind, then, as we do with other phenomena—that is, in the spirit of natural science—we can only ask what particular characters behavior presents when it is mental, which distinguish it from vital or mechanical or chemical or electrical or other behavior. Proceeding in this way, the following factors appear as distinguishing marks of the mental: (1) The capacity of an organism to use one part of its experience to control another, *i. e.*, behavior is mental in its aspect as inducing further behavior; (2) especially the capacity to control experience by the use of symbols, particularly words, *e. g.*, in human behavior language is the chief instrument in the induction of further behavior; (3) the social-individual amplification of experience: social interchange, when progressive, is typically the induction of new social values through the medium of individual variations and experimentations.

1. 'Learning by experience' (using the word experience in its primary meaning as having to do with behavior which is experimental in its nature) presupposes, within a given total of

[1] *Ibid.*, p. 381.
[2] *Ibid.*, 2, p. 325.

activities, that one action-system conditions another in such a way that the first is a factor in bringing about a change in the second. That behavior may not manifest itself in such a way without invoking subjectivity in a metaphysical sense it is for those who deny it to prove. Certainly the mechanism of summation of stimuli and inhibition of response is objective enough in the scientific sense, not to require any special defense against metaphysical prejudices.

There do exist relatively unstable as well as stable vital equilibria within organic complexes and these exhibit, under certain conditions, the phenomena of selective attention in the definition of the stimulus and selective inhibition in the definition of the response. In so far, therefore, as a total overt act is mediated by an incipient act which ordinarily is but a part-process within such a total act, we have, in simple terms, phenomena of induction of response sufficiently distinctive to deserve mention under a separate rubric—the mental.

The very sentence I am here writing presents an illustration of the principle. Each phrase and word is indicative of the meaning which lies beyond and at the same time within itself. The full import of the first word is not found until the last is reached. Nor can the last be understood apart from the first. Within the whole represented by such a bit of behavior there is a vicariation of part-processes absent from what we call mechanical or non-mental operation. And if we knew more about the behavior of horses and fishes and birds and paramœcia, doubtless we should see the beginnings of the operation of this principle there. Jennings seems to find evidence of it in his researches on the microscopic forms. The problem of psychogenesis is the experimental isolation of these part-processes.

An organism in a context in which it is not adapted is in a state of disturbed vital equilibrium. Its receptors and effectors together with its coördinating adjustors are thrown into a state of excitement which, from the point of view of the subsequent readaptation, is called experimental. They demand, as it were, a certain sort of environment to function

in, which as a fact is not present, or is present only as a possibility in the nascent capacities of these organs to modify conditions. In so far as these capacities through this sensori-motor mechanism, as an upshot of this experimental activity, do begin to reorganize, not immediately the external environment, but the 'set' of the organism toward a putative environment, we speak of the activity as purposive. This likewise is what we mean by its being mental.

Purposive or mental behavior, therefore, is behavior which has engendered or is in process of engendering such a 'set' or pattern of habit-systems *now* that given results will flow from it *then*. I purpose (pro + pono) when I place before me such conditions as will determine later conditions, in other words, when I control my subsequent act of attention by my present placing, articulating, fixing of the relevant motor mechanism.

I, for some reason, image a drowning man and find myself wrung by an involuntary spasm of strangulation, from which, however, I free myself as I realize that this is but an imaginary, not a real, situation. In other words, I momentarily become the victim of some predetermined 'set' in my nervous system which, in a suitable setting, would lead to adaptive movements, but which in the absence of such a setting falls to pieces in the arrested stage of merely (or chiefly) implicit behavior.

A ball comes flying through the air in my direction and I involuntarily prepare to catch it. Here likewise there is a predetermined 'set' of the organism, nerves and muscles, in this case carried out to completion in an adaptive movement. Both are purposive and mental, both are of the nature of incipient performance, predetermining stages in a progressive process of adaptation, in the one case carried to a certain completion within the field of tensional stress represented by the interplay of receptors and effectors, in the other case arrested and shunted off in an earlier stage vaguely alluded to usually as central processes.

2. The phenomenon of the mental appears unmistakably wherever a creature, by the device of language-symbols, refers

to itself or employs itself, that is its own present or past experience, as a factor in some new behavior equation. As long as behavior is relatively adequate it remains on the plane of the physical or at most the vital. But when a given confrontation of stimuli presents the character of a crisis, and in this emergency the existing behavior equipment is insufficient to meet the situation, it figures as a factor only in a wider behavior complex which is emerging.

We should expect to find what we in fact do find, that the mental is a more or less faithful mirror-picture of the material world—an imperfect picture, faint and indistinct in spots, distorted and exaggerated in others, as would be the case where the symbol is imperfectly performing its function of substitution for the symbolized. The very language in which the mental is primitively described shows at once the initial unity and the induced duality of this process: this lingers in the concepts of mana, manitou, and participative consciousness now coming to light in anthropology.

The creature that first found the word 'I'—a symbol to represent itself—must surely have paused in astonishment before this duplication of itself. What wonder if it demonized its own half-conscious creation and built up a second world of its fancy in which symbolically at least it might live the life of freedom and accomplishment it found so difficult to achieve in this. If the epiphenomenon of consciousness originated in some primal grunt of satisfaction, as thinking is supposed to have originated in subvocal talking, then the whole problem of a separate realm of mind falls away, and our investigation narrows down to the specific characters we shall agree to ascribe to behavior when it exhibits a certain degree and kind of complexity.

3. That consciousness is essentially social in its nature has been emphasized in recent years on all sides. The interlocutory origins of thought are as evident as the sympathetic origins of emotion. And that the perfecting of language as an instrument of vicarious experience has played the chief rôle in the building up of the superior mentality of man no one doubts. It is perhaps not quite so clear, and therefore

deserving of accentuation, that the presence of mentality anywhere is based on the same principle, whatever the peculiar form of the symbols. A tropism rendered plastic by unwonted attrition in adjustment, a delayed reflex, a thwarted instinct—any reorganization of behavior that throws one act into the indicative or demonstrative relation to another act—a gesture, a grunt, an animal cry, a facial expression, protruding claws or bristling mane, as truly as the articulate word, is the material of which mentality is made. And these substitutional modes doubtless functioned as between units in a social matrix before they became convolved in the consciousness of the individual.

Mind thus is not something superadded to behavior; it *is* behavior of a certain sort. It is behavior in which certain objects which serve as excitants are undergoing experimental reconstruction into stimuli adequate to the incipient response. It is behavior in which certain attitudes are undergoing reorganization into adequate attentional discrimination of the response. What in psychology has been known as sensations and ideas are but the sharpening of the stimulus and response in terms of the incipient reorganization of behavior set up within the total circuit by some shock of relative disadaptation. The mental, with its retinue of ramifications into consciousness and attention, sensation and image, affective and cognitive modes, is but a name for behavior of that sort which demands something else than itself for its own completion. This new other-referring and other-demanding quality in an act, this indicative or demonstrative, this symbolizing, vicariating, inducing, representative character is the distinctive mark of the mental.

Summarizing, we may say that mentality or mind is a name for the fact of the control of the environment in the interest of the organism through the interaction of inherited capacities and acquired abilities. Mind is not an organ or function or faculty over and above the mechanism of behavior; much less is it an entity of a distinct order or a parallel aspect: it is a relation. Like gravitation or evolution, it is merely a generalization from certain facts, the state-

ment of a type of relationship. The word mind, like the word habit or the word instinct, stands for an observed uniformity of events; it is a class-name for an assemblage of particular facts of adaptation and adjustment in behavior. Mind is the name for a fact of control-in-crisis which takes place under certain conditions in the life-process. Psychology is the effort to describe and explain such phenomena. We may provisionally define psychology, accordingly, as the science of the behavior of organisms in so far as they exhibit mentality. Behavior—not all behavior, but behavior in so far as it presents the character of the mental as distinguished from the chemical, the physical, the vital. Mentality—behavior in its aspect as inducing fresh forms of itself.

THE SIGNIFICANCE OF BEAUTY[1]

BY KNIGHT DUNLAP,
The Johns Hopkins University

Human beauty is something which is perennially celebrated in poetry, in song, in romance, and in the petrified conception of the sculptor, but less frequently considered in the cold analysis of science. We are usually content to leave the topic to the artist and the lover, as one of the interesting and thrilling, but non-essential, matters of life. I wish to suggest a different conception of beauty: a conception of beauty as something which, whatever its importance for the individual, is for the race and for civilization of such profound importance that no other fundamental consideration of human welfare and progress can be divorced from it. I shall not touch upon the theme with the golden fingers of the artist, but with the unemotional digits of the psychologist. To some, without doubt, this procedure will seem as sacrilegious as the piercing of the anatomist's knife into the dead human form; but where the welfare and progress of humanity are at stake, even these brutal methods must be employed.

Beauty is a term of variable meaning; in fact there is a group of terms—handsome, pretty, attractive, charming, etc.—whose exact relationship is often discussed, and never settled. The way in which I use the term will not be acceptable to many persons, but one may reformulate my conclusions in his own way, using whatever terms he chooses, and the validity of the conclusions will not thereby be affected. I think it will be agreed, when I am through, that I have been discussing something rather definite under the name of beauty, and I hope further, that it will be conceded that, after all, what I have been discussing is that which in

[1] An address delivered before the joint session of the Southern Society for Philosophy and Psychology and the Association of Physical Directors of Women's Colleges and the faculty and students of Randolph Macon College, Lynchburg, April 13, 1917.

the common, and therefore vital, usage is actually designated by the term.

The familiar proverb tells us that "beauty is only skin deep," which nicely exemplifies the mendacity of proverbs; ugliness, it is true, is often skin deep, but beauty, never. Beauty, as I hope to be able to show, is something which depends upon the whole organism.

The conditions of beauty are in part negative, in part positive. That is to say, there are certain conditions which a person must satisfy in order to be classed as beautiful, yet which do not in themselves contribute to beauty; other conditions, such that their fulfillment constitutes beauty, or at least constitutes a certain element in the total beauty. Among the negative conditions are, for example, the lack of deformity. A hunchbacked woman or a baldheaded man is debarred by the deformity mentioned from being classed as beautiful, but the fact of having a straight back or of having hair on the head is not necessarily in itself a positive element of beauty. The negative condition is one which may be fulfilled, and yet the individual not be beautiful and not even have the corresponding detail of beauty. The positive conditions, on the other hand, are those which taken together in their fulfillment cause the person to be classed as beautiful. Some of these details may be present, and yet on account of other negative or positive factors, the total may not constitute beauty. Nevertheless we say that, in these details at least, a person does possess beauty.

This distinction between positive and negative elements, I am well aware, is not fundamental; it is at best a distinction of degree and convenience. But it is a convenience, for purposes of presentation at least, and we may make use of it while noting the fact that too great dependence upon it is fallacious. I shall consider first, therefore, the general negative conditions in order to clear the way for a treatment of the more detailed conditions, which, although involving both positive and negative elements, are better treated from the positive rather than the negative point of view.

I shall consider herein, primarily, only visible details.

Qualities of voice, peculiarities of odor, tactual details, and so on, I shall notice only in so far as they are directly associated with visual characters. This is in accordance with the usual practice which makes beauty essentially a visible phenomenon and only secondarily a phenomenon which appeals to other senses.

General Negative Characters

1. Signs of race. There are certain negative details of stature, feature, color and movement and habits which are important because they indicate in the first instance a race or species of the human family against which, for reasons which may be instinctive or due to education, there is a prejudice. Facial proportions, for instance, which in themselves have no value, may yet indicate or suggest a branch of the human family against whom we entertain a certain bias. If we despise the Irish, an Irish caste of countenance cannot be beautiful to us. If we have an antipathy to the German or Russian or the French people, the type of face which suggests these people, even though there is no indication of actual blood of the race, is a factor making against beauty. The commonest instance of this sort of negative condition is found in the negroid characters. Here, where the suggestion or indication is of an inferior race, the negative condition is especially important.

2. Signs of disease, deformity or weakness. Any indication, not merely of physical weakness, but even in some instances of mental or moral weakness or disease is of decided negative effect. One who looks like an imbecile or like a criminal is never beautiful; one who seems to have, or suggests, a deadly disease, is to that extent lacking in beauty. To a certain degree, these mental and moral standards are relative to the grade of the observer. A weak-minded person has not the objection to the weak-minded person of his own grade that the more normal person has, but I suspect that the person of low mental grade has a certain preference for the normal person. As regards disease and deformity, there is no question. A hunchbacked or baldheaded man regards his characteristic as a decided bar to beauty.

3. Significant deviation from the average is a negative characteristic, even if the deviation cannot be classed as a "deformity." Dwarfs and giants, exceedingly thin and unusually broad individuals; those whose legs are too long for their bodies, or *vice versa;* those whose ears are misplaced, or whose hair is of an unearthly shade, are ruled out by their oddity, regardless of what these peculiarities signify. They may be good, clever, or admirable, but never beautiful.

These details are in part relative. Among certain African tribes, whose men are uniformly over seven feet tall, and as thin as a rail, a normal Anglo-Saxon is probably not beautiful. Among other African tribes, and certain islanders of the Pacific, a woman is not considered beautiful unless she reaches a degree and a distribution of fatness which makes her either repulsive or comical to European eyes. This relativity is, however, only superficial. The type which is highest in value tends to approximate the European type, wherever the European type becomes known. All dark races prefer white skin, and it is a general rule that the female of the inferior race prefers the male of the superior race to the male of her own race, no matter how striking the difference. That the inferior male considers the superior female more beautiful than the female of his own race is indicated everywhere, and clearly demonstrated among the Turks.

Deviation from the common type, then, is a drawback only when it is not a deviation towards the acknowledged superior type of another race. The conservative dislike for the unusual in general is tempered by approval when the unusual is clearly a mark of racial superiority. This will find its ready explanation when we consider the positive side of beauty.

4. Misplaced sex characters. A specific form of the abnormal, but one which is important enough to justify separation from the foregoing class, is the possession by individuals of one sex of characteristics properly belonging to the other. This is an invariable negative qualification in the eyes of healthy observers. The effeminate man and the masculine woman can be beautiful only to the moral pervert. The

importance of this indication is very great, as we shall see later, and however little it may mean consciously to a given individual, the habit of reacting against it has been strongly developed in the human race.

Detailed Characters of Beauty

So much, in brief, for the general negative characters of beauty. We come now to more detailed characters, which have on the whole a positive value, although some of them have negative aspects as well.

1. *Stature.* From the point of view of the female, the male must be large, although not a giant, since, as we have seen, too great a deviation from the usual is a negative condition. I have at various times overheard women, who were discussing the relative handsomeness of two or several men, settle the point by such an observation as '*A* is fully an inch taller than *B*.' By carefully put questions I have succeeded in eliciting a considerable amount of information on this point without revealing the actual purpose of the interrogation. For example, if I inquire of a woman concerning the handsomeness of a man who has a general combination of desirable and undesirable characteristics, but who is a trifle below medium height, I very frequently obtain, in her first statement, a criticism of his stature, followed by a consideration of his other attributes; indicating that in her estimation size is of paramount importance. The determining factor is not, of course, mere height, but height combined with lateral development not deviating markedly from the average proportion. The tall man of bean-pole build is not considered attractive. Yet, a positive element of height can outweigh a considerable element of disproportion, and a taller man, whose proportions are in themselves worse than those of a shorter man, is usually considered the handsomer.

This preference for stature undoubtedly harks back to more primitive times, when it was above all important that man should be a fighter and hunter, in order to secure food for his wife and children, and protect them against wild beasts and against the designs of other males. Especially

was this important during the periods when the woman was pregnant, or nursing a child. It is highly probable that in ancient times the negative rule against abnormal size did not apply, since every increase in physical power, even if carried to the extreme of gigantic development, was a distinct advantage.

It is sometimes alleged that the woman's preference is not for the *large* man in an absolute sense, but for the man *larger* than herself; either because of a natural wish for a husband to whom she is inferior; to whom she can give a tribute of worship and deference; or else, that it has developed through the necessity of the greater strength on the part of the man in order that he might capture the woman, and carry her away from her parental habitat, to his own dwelling. Both of these suggestions are highly unplausible. Marriage by capture, although a good hypothesis for popular writers, probably never was at any time an institution of any more importance or actuality than it is at the present day. Psychologically, the theory is based on the assumption that woman is naturally opposed to the marital relation, which assumption is a merry jest, to say the least. Historically, there is no evidence for the theory of capture except as a limited and temporary phenomenon. As for the supposition of an unexplained instinct to prefer a dominant partner, I see no support for it, except in so far as the practical consideration I have advanced may itself lead to this preference as a secondary manifestation. It is true that there are women today who openly state that the mates they want are those who can completely dominate them; and that such potential masters are the only men who interest them. These cases (a number have been directly reported to me) are not all to be explained on the same basis, although the primary factor in every case is the admiration for the strong man. In some cases, the preference is distinctly a pathological development; in others, it is pretended by the woman as an explanation for the fact that men are not interested in her. In many cases, however, the preference is the expression of an arbitrary standard which is manifested usually in less egotistical ways.

Where a scale of values is accepted, there is commonly a more or less explicit adoption of a minimal acceptable value; the stronger man is the more desirable; a man who measures up to a certain minimum will be acceptable. In most cases, the minimal standard adopted is the father, a brother, or some other impressive individual in real life or in fiction. In the case of a strongly egotistical woman, who sets a high value on her own potentialities, the standard is herself; the man less forceful than herself is below the minimum.

In this, I seem to be confusing physical strength with various sorts of power; perhaps I am; but, as I am trying to point out, the basis of power is muscular, and admiration for physical prowess still retains a primacy when it is a matter of the fundamental attraction of the woman to the man; and all I am trying to establish at this point is that there is no primary desire of the woman for a man who is able to dominate her physically. On the contrary, the woman would prefer, if other considerations did not prevent, the mate whom she can control physically and in every other way, for the *instinct to dominate* is inherent in every normal human being.

Under present conditions, the preference of the large woman is accentuated, and that of the small woman reduced, by social factors, especially the fear of ridicule. The weakness of the small man is made conspicuous by the contrast with a giant wife; compared, on the other hand, with a diminutive wife, his inefficiency is less emphasized.

From the point of view of the male, the question of stature is less simple. There seems to be no general preference for small women or for large women; but a truly relative preference for smaller women. Of course, I am well aware that there is a wide range of individual preferences, not all of which are explicable from available data; but I am speaking of generalities, which are certainly discoverable, in spite of individual differences. This general relative preference in the matter of stature is complicated by the curious double preference of the male, which is so strikingly demonstrated by theatrical studies, and to which I shall make brief reference later.

The primitive reason which leads woman to prefer a large man has no correspondence in the necessities of the male. The male has not the need for protection at certain periods which the woman has. While the addition of a husky female to the savage's fighting force would seem to be a prime advantage, the advantage is largely lost because at the precise times when the aggressive resources of the family are most fully needed, the woman is not in condition to exert her strength, without serious injury to herself. The physical strength of the woman is not to be counted on, and hence the stronger woman is not a greater asset to the family, and hence no more desirable.

It is true, there have been and still are, races in which the physical strength of the women has been counted on, especially for agricultural duties (*e. g.*, the American Indians); and among them, possibly (I am not certain on this point), stature has been a mark of beauty. But where female strength is counted on, it is necessarily utilized at times when grave damage is done to the woman, and those races which have counted on it have gone down. The races which have early developed *chivalry*, as we may well designate the protective attitude, are the races which have developed civilization, and which must continue to dominate the world unless civilization is to be abandoned, and the human race plunged downward into bestial degeneracy.

Stature, therefore, except in so far as it may be involved indirectly in some of the factors which I shall yet consider, is not and cannot be a mark of female beauty in a civilized race. On the other hand, by this very fact, the preference for a partner whom he can dominate is allowed full sway in the male. The woman would have the same preference, as I pointed out a moment ago, were it not checked by other factors.

I may digress for a moment, to remind you that in a family one person must control. This is not a theory, but an empirical fact against which argument is futile. Economic conditions which are as yet but dreamed of, especially those conditions which result from the greater and greater

use of machinery, may in future change this; but it was the law of the primitive family, and even yet we have not reached a stage of civilization in which a joint legislative authority is possible. In the past it has been the male who has controlled, but that may be changed in the future. It is true that Bachofen and others have tried to establish the doctrine of the matriarchiate (the rule of women) as the primitive family system, but the confusion on which this theory was based has been readily exposed. Never in the history of the globe did woman have the political and social power she holds today, and suffrage cannot increase it.

2. *Bodily proportions.* In modern civilization there has grown up an immodesty which was lacking in more ancient cultures. We are ashamed of our bodies. Whether the practice of concealing the body is the cause of our uncleanness of mind, or whether our obscenity is rather the cause of the concealment, is a debated question. Whatever may be my general estimate of the Japanese, I cannot but admire their wonderful cleanness of mind, which makes for them clothing a detail which has no bearing on modesty.

Among the Greeks, who, as you know, were in many respects more pure-minded than we are, bodily conformation was an important detail in beauty. And, in fact, it is today amongst us, both in a shame-faced way in daily life, and more creditably when we throw off our prudishness in the presence of plastic and pictorial art, and in the theater. We are skirting here a vital and pressing problem of the present moment, on which I should like to take the time to make you face some problems we all tend to ignore, but I must not digress further.

Our standards of bodily development are still, in the main, Greek. There are certain proportions which are judged both by the artist and the layman to be the ideal of beauty. In this we are of course swayed largely by the limitations of our education, which on these matters is artificial; probably there would be a greater difference in racial ideals, if conditions were more natural.

The simplest explanation for the accepted ideal of form

would be that it is the average form of the healthy individual. This explanation, I think, is not supportable. Among the Greeks and Romans, for example, the ideal ankle, for a woman at least, was a *small* ankle, not a medium-sized one. Among us, a small foot has been desirable; so much so that women have been compelled to wear shoes which, by raising the heel several inches, make the shoe about two thirds the real length of the foot and so make the foot seem shorter, or at least it did until the recent raising of the skirt has brought the artifice out where it cannot be overlooked. One of the most important and desirable effects of the permanent adoption of sensible clothing by women will be the allowing of the foot to retain its natural form. Of body-form, which is by rights the fundamental consideration in beauty, I shall say nothing further, because our standards are so obscure. The subject is in need of thorough investigation by the methods of comparative anatomy, and above all, of social psychology.

3. *The features.* Whatever the cause of our concealment of the body, it has led to an emphasis on the anatomical details of the face which could not be found in more primitive times. Leaving out of consideration the general shape of the face and head, which are probably important mainly as racial signs, we may consider briefly the chin, the nose, the eyes and the ears.

That there is a preference on the part of both sexes, and in the consideration of both sexes, for a well-developed chin, is a matter of common knowledge. The reason for this preference is less evident, and in fact I can here indicate only a strong probability. Racial factors are involved, of course, but there seems to be a more general foundation which is vaguely involved in the commonplace statement, that the possession of a chin is one of the conspicuous points which differentiate man from the beasts. This is obviously true; the vital question is, what are the direct consequences of this structural peculiarity? This question can be answered by reference to comparative anatomy and to the psychology of the thought processes. The projecting chin gives room in

the mouth cavity for the human tongue, which is strikingly different from the brute tongue. The tongue of the lower animal is a long thin strip of muscle; the tongue of homo sapiens is a thick muscular mass. A somewhat exaggerated comparison is to a leather strap, in one case, and a frog seated in the mouth in the other case. We have now advanced the question one step farther, to ask what may be the advantage, if any, in the form of the human tongue.

The animal tongue is certainly just as well adapted to the purposes of obtaining and preparing food, as the human. In some cases, it is even more efficient. But the human tongue is an important instrument in the production of the most human of all attributes, *language*. Language is not merely the means of communicating thought; it is, as philologists have long known, and as psychologists have been forced somewhat unwillingly to admit, the principal means of thinking. While it is possible to think without language, languageless thought is primitive and inefficient in the complex conditions of civilization, and it is by no means an exaggeration to say that the development of language is a large part of the development of thought.

Of course, it is not to be said that in any specific case a large tongue is an index of efficient thinking, or that a relatively smaller chin indicates necessarily a relatively smaller tongue, or that the converse of either of these propositions is true. But on the whole, the development of the chin is concomitant with the development of thought, and hence, in races or large groups, an index of mental development. It is worthy of note here, that the marks of beauty will be found throughout to be these *generalized characters*, which in specific cases may not be associated with the fundamental factors which have made them important.

The nose and the mouth are beauty-characters which are probably more exclusively racial in their significance than the chin. The broad flat nose and the thick wide lips are often repulsive because they suggest the African, if for no other reason. But I suspect that the thick lips are also a defect because they are in themselves a hindrance to efficient speech,

and more vitally, because they connote an inefficient formation of the mouth, palate and glottis. Yet it is necessary here again to point out that any of these details may be faulty in a particular case, and yet the others be so well adapted that they more than compensate; and that there may be in many cases language, efficient for thinking, but inefficient for communication. Here as everywhere, our beauty judgments are based on conditions which are general, and to which there are many sharp exceptions.

As regards the teeth, we are in no serious doubt. The beautiful teeth are the sound, regular weapons, which by their form and color give unmistakable evidence of being efficient for chewing as well as for primitive methods of warfare.

While the practical indications of the mouth are important, as I have pointed out, we should by no means overlook the probability of a sexual significance to the evaluation of which the consideration of other beauty characters will rapidly drive us. I need not remind you that popular theory as passed from mouth to mouth and as embodied in literature of all ages, considers both the mouth and the nose as practical indexes of the sex-organs; I should like to express the opinion that popular theory, even popular superstition, is the smoke which always indicates some fire. This particular popular belief is one on which it seems to me it would be worth while for directors of physical culture to make statistical observations.

I need not point out the sexual function of the olfactory organ in the nose of the lower animal; but I ought to warn you against the fallacious opinion that in the human animal the nose has universally lost that function. On the contrary, in a large proportion of the species that function has become more complex. I may add also, that in addition to the significant fact that the membrane lining a large part of the nasal cavities is erectile tissue, there are definite psychological observations (none published, I believe) which throw experimental light on the sexual relations of the nose.

That both the eyes and ears are beauty marks, and that,

in the female especially, they have been selected for especial emphasis by lovers and poets, you are well aware. Both love and poetizing, as most of us well know from our own experience, are conditions of irresponsibility in which the fundamental instincts and habits have large sway; and the first condition usually brings on the second; accordingly the beauty-points which fix the attention of poets demand our attention. But there is little to offer at present in the way of analysis of these. Aside from the indication of physical condition which the eyes afford (and every physician makes use of these indications), the importance of the eye is probably largely racial. The blue or the black, the large or the small, are not in themselves of moment, but they indicate stocks from which we expect certain other characters, mental and physical. The same general consideration is probably involved in ear preferences. This is however by no means the whole story. Anyone who has studied the religious and art symbolism of primitive peoples, and of people not so primitive (I do not refer to the crude and artificial studies of the Freudians) cannot help but see very definite reasons for the fascination of the eye and ear, reasons which are more appropriately discussed amongst psychologists than before a general audience.

Before passing on to the next topic, I wish to protect myself from possible misapprehension by disclaiming any taint of phrenology or blackfordism in the preceding discussion. The significance of cranial and facial characters must be worked out on the lines of physiology and genetics; psychologists have no sympathy with the various systems of so-called character analysis which attempt to decide from a casual examination of an individual what his intellectual and moral peculiarities are in detail.

4. *Hair.* The hair which adorns the human body (or disfigures it, as the case may be), is of two sorts, in regard to its physiological conditions and significance, as well as to its regional distribution. The hair of the head, or *pate-hair*, is the one sort, and the body-hair, including the face-hair, is the other.

The conditions which govern the growth of the pate-hair are not definitely known, but are probably connected with bodily changes which have other important effects. That is to say, the stimulation of the growth of the hair, or the failure of its vitality, are probably due to changes in the internal secretions (hormones) of the organism, although it is not known which of the secretions are the important ones in this connection. It is probable that another effect of the internal changes which produce baldness is a lessening of the resistance of the organism; that the baldheaded man cannot stand the muscular exertion or the nervous strain of which the hairy-headed man is capable. At any rate, baldness is a fatal bar to beauty, both in the male and the female, although to many persons (men especially) an individual of the opposite sex whose pate-hair is exceptionally abundant is repulsive. Another indication of the dependence of the pate-hair on metabolism in other regions is found in the apparent connection between hair and temperament. It is difficult to conceive of a baldheaded musical genius or artist; although even to the rule implied here, exceptions do occur. Temperament, and all emotional factors, as we now know, depend largely on the bodily metabolism, especially on the functions of the internally secreting glands. The quantitative hair character, therefore, may in all probability be reduced to an indication of physical vigor; and physical vigor is far more important, as a beauty asset, than mental ability. Whether the popular belief that the mental ability of a child is in the inverse proportion to the growth of his hair, has any foundation, and whether a similar rule holds for adults, I shall not discuss, as I might be accused of being prejudiced.

The other details of the pate-hair character: fineness or coarseness, straightness or kinkiness, color and contour of distribution, are largely important as indicators of race or stock; yet fineness has a direct sex value in its greater pleasingness to touch. It may also be true that color has a direct value; that the masculine preference for red-haired women which is so frequent, and of which the Elizabethan and pre-Elizabethan erotic writings are so full, is not due solely to the

association of the hair color with the ardent temperament which without doubt was a characteristic of the red-haired stocks; but is in part at least due to the direct effect of the visual stimulation.

All parts of the body except the palms of the hands and the soles of the feet, and certain other small areas, are covered with fine hair, which in the pre-adolescent person are usually so fine and so colorless that they are hardly noticeable. With the beginning of puberty, the axillary hair (the hair of the arm pits), and the hair of the pubic region in both sexes begins to develop, increasing in diameter as well as in length and in pigmentation. In the male also, but slightly later, the face hair undergoes similar development, and still later the hair on the chest, abdomen, and limbs of the male develops in manners which differ greatly in different individuals. In the typical, functionally perfect woman, on the other hand, the body-hair, except in the restricted regions mentioned, remains as fine and as colorless as in the child.

This hair development is not associated with sexual ripening in a chance way, but is controlled by the fundamental sex glands. These glands not only produce the germ cells (the egg and the spermatozoön) whose union creates the life of a new individual; they secrete also, into the blood stream, hormones, *i. e.*, substances which profoundly influence the growth of various parts of the organism. The internal secretions of the male glands produce those changes in the vocal organs which are indicated by the voice becoming heavier and lower; stimulate the growth of the body-hair in the manner above indicated; and undoubtedly produce those structural and functional changes which are evidenced in the tendencies of feeling and action distinctive of the male. If the glands are removed in infancy, these changes do not occur. The secretions of the ovaries, on the other hand, seem to inhibit the growth of body-hair, to accelerate those structural changes in the muscles, glands and skeleton which differentiate the woman from the man, and produce those functional modifications which make the feelings and emotions of each sex a sealed book to the other.

It may be said of the important races of mankind that, in general, the development of the face- and body-hair in the male, and the absence thereof in the female (except in the three limited areas), are alike an indication of fitness for parenthood. The decline of the sex function in old age is usually marked by significant changes in these details. There are of course many apparently anomalous cases, some of which may be explained by glandular details into which the limitations of time forbid us to go; but in spite of these cases, the social verdict is uniform. The hairlessness of the female face and body, and the hairiness of the male face (or the evidence that the hair grows, although shaved off) are important elements of beauty. The male body-hair has little value, because of its irregularity, and the fact of its usual concealment.

There are a number of interesting problems which arise in connection with the body-hair. Theoretically, the pubic hair should be as beautiful, at least, as the pate-hair; yet the Greeks, who set our official standards, did not think so.[1] As to axillary hair, there is lacking information as to its indicatory value. It is an interesting observation, however, and one of no little psychological importance that in these days when the morbid shame of the body is somewhat lessened, and young women expose their arm-pits freely in the ball room and theater, some remove the axillary hair, and others do not.[2] Probably the conflict of opinion in these matters is really between the man's judgment of beauty and the woman's. But we must pass over these details, and hurry on with our main problem.

It is evident now that whether there are other considerations or not, the most important element in the beauty of any individual is the evidence of her (or his) fitness for the function of procreating healthy children of the highest type of efficiency, according to the standards of the race; and

[1] I am informed by Professor Robinson that the Greek women uniformly removed the pubic hair (usually by singeing), probably on account of pediculi. That the esthetic standard is a result of this practice is plausible.

[2] This statement was true at the time at which it was written. Now, a year later, axillary hair is seldom seen.

ability to protect these children. The positive beauty characters we have already examined are clearly such marks of ability to perpetuate the species in the finest and noblest way, and the characters we shall now consider strengthen the interpretation.

5. *Fat.* Here again there are racial differences, but amongst the European races, no racial indications. We may leave out of consideration the Africans and the South Sea Islanders, with their criteria of beauty-fat which seem so odd to us, but which are quite intelligible when viewed in the light of racial characters, and consider Western conditions and standards.

A certain amount of fatty tissue is normal, and is essential for the health of the individual. Fat constitutes a store of reserve material, which may be drawn on in time of unusual need; and without it endurance is limited. This reserve store is probably not so important at present as it was in primitive times, when man lived in a hand-to-mouth way, uncertain today what the food supply would be day after tomorrow. On the other hand, beyond a certain amount, fat is an encumbrance, impeding the operation of many organs, and thus limiting the efficiency of the individual, and also is in itself a symptom of faulty organic functioning of some kind. We are not surprised therefore to find that beauty demands just the right degree of leanness; just the degree which is found in the most vigorous individual.

The standards are somewhat different for the two sexes, because the anatomical conditions and physiological necessities are different. In the female, especially in the young female, there is a special layer of fatty tissue underlying the skin, which is absent in the male. This gives her the roundness and softness of outline which is essential to the perfection of feminine beauty, and also prevents her from feeling the cold so much as the male does. Possibly also it explains why she swims more easily. (It is a fact that women are as a class far better swimmers; this has been ascribed to the better development of the legs· but this reason is hardly sufficient, since it has been shown that leg action is the least important factor in swimming.)

The softness and roundness of contour of the female is beautiful, because it is the mark of physical fitness. The fatty layer is supposed to be an extra reserve supply of food material, laid up against the heavy demands which are made by child-bearing, and in still another way protects her in that supreme process, of whose splendid fruition beauty is the glorious blossom. When age withers, through the absorption of the adipose tissue, primary beauty is on the decline, and unless it be replaced by the secondary beauty appropriate to advancing years, the drama of life becomes a tragedy. And indeed, the great fact that we all must face at some time, that the strength and vigor of our prime is past, and that the time when the almond tree shall flourish and the grasshopper become a burden advances upon us, is usually announced to a woman in the discovery of wrinkles due to the slipping from her of her subcutaneous robe of office.

6. *Complexion.* The tint of the skin, of course, is largely a racial indication, but in certain respects, the tint, as well as the texture, is an index of health and vigor. The standard of beauty in complexion, whether light or dark, is that which goes with the full bloom of sexual vigor, when the human organism is at its perfect development for the perpetuation of the species. This is so obvious that it would be superfluous to discuss it further.

7. *Muscular tonicity.* The voluntary muscles of the body, *i. e.*, the muscles of the face, scalp, trunk, arms and legs, are kept in a condition of *tonus*, by nerve currents constantly supplied to them by the motor nerves. Tonus is a state of partial contraction, which constitutes the readiness for action of the muscle. If the motor nerve trunk which supplies any voluntary muscle be severed, the muscle at once becomes flabby. The tonus does not depend entirely on the nerves which stimulate the muscle. In order to be stimulated, the muscle must be in the appropriate chemical condition to receive the stimulus, and this chemical condition is dependent not only on the general metabolic conditions of nutrition, fatigue and rest, but also on the specific actions of hormones produced by several of the internally secreting glands, notably the adrenalin produced by the adrenal glands.

In case of injury or disease affecting certain parts of the nervous system, certain muscles become flabby. In case of general flabbiness, it is of course not evident immediately whether the primary defect is in the nervous system, or in the metabolism of the body. In any case, flabbiness, local or general, is a symptom of inefficiency in bodily functioning, and although under modern conditions the flabby individual may be able to make his living at his particular restricted occupation, flabbiness unfits him for parenthood now, just as much as it did in the stone age. We can't breed husky children from flabby parents.

The flabbiness which is due not to a specific injury or disease, but to insufficient vitality, is first shown by the muscles of the face. That is to say, it is first shown to the casual observer; a medical examination would probably find it in other muscles first. It is not entirely due to the concealing of the body that the facial muscles have become known as the muscles of expression. Failures of tonicity in these muscles are conspicuous; the sagging eyelids or corners of the mouth, or cheek muscles and other modifications which are readily observed but described with difficulty, are common traits which are fatal to beauty. In fact I do not hesitate to say that assuming the conformation of the features, and the complexion, to be not actually objectionable (that is, assuming the bare negative conditions), beauty, in so far as it is facial, depends on the proper tonicity of the muscles.

The *activity* of the facial muscles expresses the mental and still more the emotional *activity* of the individual in a plain way. Vivacity and dullness, cheerfulness and gloom, benevolence and rancor, interest and ennui, and a multitude of other conditions are written in the facial movements for the runner to read. Boldness, modesty, candor, deceit, innocence, guilt, and other moral qualities may be expressed in the contractions of the muscles surrounding the eyes. But in repose, these muscles are expressive in another, and perhaps more important way, for they show the potentialities of the individual; what he is capable of, in so far as the capability

depends on the functioning of the nervous system and the endocrine glands. A person may be attractive, while the face is in action, because the action indicates a desirable type of mental or moral activity going on; but she is not to be judged beautiful in face, unless the face in repose expresses desirable potentialities. A common form of expression is "she is beautiful only when she smiles": a better statement would be "she is attractive when she smiles, but she is not beautiful."

Although our survey is far from complete, it has proceeded far enough to show us clearly in what beauty consists. It is the sign and the expression of the *potentiality* of the individual; not what he has done or is doing, but what he is capable of doing; not what he is capable of doing for his own interests, but what he is capable of doing *for the species*. Put in the plainest of terms, the most beautiful woman, the handsomest man, are the persons we would choose to be co-parents of our children, if we considered nothing but the highest mental and physical welfare of these children.

The reasons for the actual matrimonial choices of society are complex, beauty being only a minor consideration. For the student of social psychology the investigation of the other factors is of absorbing interest, but here I may say merely that the predominance of these factors is a calamity. As a physiological psychologist, I must repeat what the poets have sung: the glorification of beauty and its exaltation as the primary ideal, which ought to reign in human life. Of all the divinities in the Greek pantheon, the most glorious are not Zeus and Hera, not Ares and his Aphrodite Pandemus, but Apollo and Aphrodite Urania, the life-giving queen of heaven.

It will be noticed that I have omitted moral qualities from the composition of the beautiful individual and have ignored the physical characters which connote these qualities. In this I have been consistent, and am in perfect agreement with common usage. Beauty may be proud, cruel, deceitful, immoral, wicked; and yet it may still be beauty. Cleopatra was capable of almost any crime you can think of, and Thaïs

was no modest violet; but history tells us that they were of wonderful beauty. 'Handsome is as handsome does' is true only in a qualified way.

How, then, can we elevate beauty to the rank we give it, since it satisfies our social demands only in part, and in what many consider the less essential part? We must do so, because it is the foundation on which truth and holiness are built. Only the race which is physically and mentally fit can survive and flourish long enough to develop and put in practice moral ideals. The problem after all is not one of choice between two ideals, but of having such regard for the primary ideal that it may help us to the attainment of ultimate ideals. In a more specific and limited way the problem of right and might exemplifies the guiding principle, which is therein not a choice *between* right and might, but the bringing of might into the service of right.

So much for the salient characters of beauty in the meager treatment I can give them here. I might now mention two other points which possibly will set off more clearly the conception I am trying to express.

Although beauty, in the primary and fundamental sense of the term, is prospective, we sometimes use the word retrospectively, as when we speak of a beautiful old lady or a handsome old man, indicating thereby a person who evidences the past possession of characters valuable to the race. In a certain sense, the retrospective characters of beauty are the same as those which constitute beauty proper; but nevertheless there is a tendency to admit, or rather demand, especially of women, moral characters not demanded in the case of primary beauty. While the handsome old man is rather strictly the man who still retains in some degree the marks of positive beauty (the marks having a retrospective significance), the beautiful old woman is she who, retaining the retrospective characters, also gives evidence of graces and temperamental qualities which are possibly more the result of environment than of constitution, and which in the younger woman are set off from beauty as "sweetness."

This admission of retrospective personal values is one

feature of the consideration which civilization has given to the aged, *i. e.*, to the individual no longer potential for the race. This consideration, perhaps, has not increased since patriarchal times, but it is an advance over the attitude of still more primitive races amongst whom the individual who is no longer useful as a warrior or a parent is ignored or eliminated.

Finally, I must refer to the popular distinction between prettiness and beauty; a distinction which at least as it applies to women rests on solid psychobiological grounds, and which offers abundant opportunity for psychological research, having practical application to some of the pressing social problems.

The pretty woman is she who possesses certain of the characters of beauty, but in such combination that they are not an indication of the general potentiality requisite for beauty. The characters of prettiness are the characters of beauty which promise least for the stamina of the race. Without extensive analysis of these signs the distinction may be summed up by saying that a pretty woman might be the man's choice for a mate, but not, other considerations being subordinated, for the mother of his children.

There is doubtless a valid distinction in types of men, corresponding to the distinction between 'beautiful' and 'pretty' women, but it is practically unimportant because of the singleness of woman's judgment. Men, however, are as a sex strongly interested in *pretty* women as well as in *beautiful* ones.

On this point, certain observations on theatrical performances, especially musical comedies, are illuminating. Details are too lengthy to introduce here; but in brief, the types represented by the show girl and the dancers are necessary to give the chorus (the foundation of the show) the widest appeal to the males. This is a fact of practical importance to producers, and I have found no difficulty in obtaining abundant introspective confirmation from men of all classes. Some men are interested almost exclusively in the type of show girls who evidently would be splendid mothers; others

are primarily interested in the types who are attractive in a more immediately sexual way. The great majority of men, however, are strongly interested in both types, and have little difficulty in identifying the grounds of the two interests. The stage, I may remark, is to social psychology what the laboratory is to individual psychology, furnishing the possibility of experimental tests, especially in the domain of the problems of the *family*, to which the topic of this paper properly pertains.

I have sketched, in the preceding discussion, the line of observation and reasoning which supports my opening statement that beauty is something vitally important for the human race. It is unnecessary that I should fill in this outline with more detail, because, having once become impressed with the scheme, whether favorably or adversely, the details will be filled in from your daily experience, and will in the end leave no doubts as to the truth of the matter. It is therefore the business of the social psychologist to lead the way from this point to the next, and practical one, the *conservation of beauty*.

THE FUNCTIONING OF IDEAS IN SOCIAL GROUPS

BY JOSEPH PETERSON

University of Minnesota

In social psychology terms are still commonly used in a very loose and vague manner. It is not so much the kind of terms used as it is the conception of them that is to be guarded. The child inherits socially from the group his ideas, language, customs, etc., and these mold him gradually into the likeness of his fellows, roughly speaking. It would seem desirable in view of certain tendencies in psychology to attempt a more precise statement, in terms of *stimulus and response*, of the social relationships of individuals.

The explanation of behavior in terms of ideas is liable, for several reasons, to fall into a vagueness which it is desirable to avoid; nevertheless it does not seem to the writer that it is well to abandon the use of the term *idea*. The mere adoption of new terms does not meet the difficulty; it does not supply the analysis needed. There are other important reasons for retaining the term. Writers in social sciences will continue to use terms intelligible to the non-technical mind, terms, moreover, which imply that man is a conscious being, imagining and reacting ideationally to environment not directly present, or present only by some sort of representation and not *in toto;* and it is the business of psychology to analyze and explain the various responses of man to his human environment so that the results of such studies may be available to workers in these social sciences. In this obligation psychology seems to have failed in the past. This failure has usually been attributed to a too academic and structural analysis of merely the 'content of consciousness' without satisfactory relationships to the environment. Some psychologists have regarded this attitude and procedure as an essential preparation to the more functional studies, one that is necessary to assure greater scientific accuracy in

subsequent applications of psychology. This contention does not seem to have been supported by the results and many psychologists are frankly striking out along different lines.[1] These present tendencies do not disprove that there may be a legitimate analytic interest in the conscious life of one's self *per se;* but science requires that there be some sort of objectification of results, and it also has in view, implicitly or explicitly, the control of human environment for man's own ends. It is, of course, fair to say that in evaluating the results of any scientific tendencies or methods, or points of view, the question is not usually one of *all* or *none*, but one of *how much.* There is no question that any sort of unbiased analysis of the mental processes results in freeing man from various superstitions and in giving him a better understanding of his social interrelations. Results, moreover, must not be judged too immediately, or from too narrow a criterion as to what is 'scientific.' Certainly one cannot but be appalled at our present ignorance of human nature and behavior in most of its larger aspects.

The current question of behaviorism versus introspection[2] will no doubt finally resolve itself into one of better control of all the stimulating conditions in experimental problems. If it be urged that this has been the aim of the introspectionists for a long time, and the occasion for experiment, the reply is that the usual introspective studies have paid attention only to certain more immediate aspects of the conditions of the experiment and have failed to recognize others, notably instinctive tendencies, unconsciously acquired attitudes, and the larger orientations and motives of the subjects. Moreover, the reactions of the subjects have been defined too narrowly and too immediately in terms of consciousness, and such terms may or they may not (generally not) have common significance to all the investigators concerned. *Terms are, after all, objective matters themselves, and not subjective content.* The same use of terms by two individuals does not

[1] Cf. McDougall, 'Social Psychology,' Ch. 1.

[2] *E. g.*, Watson, J. B., 'Psychology as the Behaviorist Views It,' PSYCHOL. REV., 1913, **20**, 158–177. Angell, J. R., 'Behavior as a Category in Psychology,' *ibid.*, 255–270.

guarantee in itself common meanings, much less similar 'conscious content.' The question, then, finally reduces itself in any event to one of mutual agreement in the designation of various subjective content, on the one hand, and of behavior, on the other. In either case we have reactions to very highly abstracted objective stimuli, *i. e.*, to words.

This brings us more directly to the subject of our thesis. The objection to the too loose use of the term 'idea' in social psychology[1] is on this same ground; it is based on a lack of agreement as to what 'idea' implies in its genesis and in its *modus operandi*. What constitutes an idea, and how does an idea modify behavior? It is frequently said in scientific literature that if one has an idea of an act, with no contradictory ideas, the idea must express itself forthwith in the act.[2] Thorndike[3] has made an extensive and somewhat academic argument against this doctrine, with some 'experiments' to test its validity. It seems to the writer that he has mainly missed the mark so far as usefulness to psychology is concerned. His intention in the investigation does not seem to have been wholly serious; he doubtless regarded the experiment rather as an after-dinner diversion for the psychologists in their association meeting where the paper was read, and intended, more seriously, to show thereby the need of a different viewpoint.

An idea may be regarded as an acquired disposition to behave (explicitly or otherwise) in a certain manner on the occurrence of a given stimulus. The stimulus bringing about such a response may be direct or indirect, representative; and it is always more or less complex, due to associations with or inhibitions from any combination of the scores of

[1] This is an example taken from a well-known writer. ". . . ideas are active factors in the social life, because ideas, in civilized man at least, come in time to constitute for the individual and society a sort of 'subjective environment,' as Professor Ward admits, and this subjective environment the mass of individuals respond to quite as they do to the stimuli in the objective environment. In other words, ideas modify activities directly without the interposition of feeling, just as sensation and images coming from stimuli in the objective environment call forth responses." Ellwood, 'Sociology in Its Psychological Aspects,' p. 265.

[2] *E. g.*, James, 'Principles of Psychology,' Vol. II., 522 ff.

[3] Thorndike, E. L., 'Ideo-Motor Action,' PSYCHOL. REV., 1913, 20, 91–106.

stimuli (both internal and external, intra-organic or extra-organic) that constantly play upon the organism in changing relative degrees. Because of changes in time relations and in intra-organic conditions it is utterly impossible that a precisely identical stimulating condition can be presented twice in succession to an individual. This is true, of course, even of a written word as stimulus. We are beginning to know how profoundly the organism is altered, for example, in emotional attitudes. The same thing is doubtless true, though in a more subtle fashion, of the various more cognitive attitudes. The entire *neural set* at any one time is determined by numerous uncontrollable conditions. This is particularly noticeable in various cases that have been described in pathological literature, as in tendencies to the dissociation of personality. The effects on any immediate stimulus of more general bodily attitudes is strikingly evident in such illusions as disorientation of direction with respect to the cardinal points,[1] also in less permanent illusions. For example, in walking among the numerous small bodies of water known as Lake Minnetonka, Minnesota, one is frequently surprised to see a small 'lake,' when first visible, at a much lower level[2] than anticipated and to note that the surface of the water has a considerable decline toward the opposite shore, or away from the observer. This illusion results when one unawares walks up a gradual incline from one lake toward the next. In animal behavior it has been found that an animal reacts in maze experiments not simply to the particular bifurcations present to it at any given time but rather to the whole maze which it has previous y traversed.[3]

Nevertheless a person usually attends to, and is therefore mostly affected by, certain selected stimuli; hence the recurrence of certain symbolic stimuli, like written or spoken words,

[1] Peterson, Jos., 'Illusions of Direction Orientation,' *J. of Phil., Psychol. and Scientific Methods*, 1916, 13, 225–236.

[2] The 'lakes' all have the same level.

[3] Hubbert, H. B., and Lashley, K. S., 'Retroactive Association and the Elimination of Errors in the Maze,' *J. of Animal Behav.*, 1917, 7, 130–138. Peterson, Jos., 'The Effect of Length of Blind Alleys on Maze Learning: An Experiment on Twenty-Four White Rats,' *Behav. Monog.*, 1917, 4 (No. 15), pp. 53.

normally brings about a high degree of uniformity in the responses of the same individual and of different individuals of approximately the same environment. Ordinarily we say they have *common meanings*, but it is obvious that on the last analysis this can be ascertained only on the basis of similarities in response of some kind.

The response to words—with a few important exceptions in which instincts are aroused by certain sounds—are wholly acquired by associations. But, as has already been implied in the previous paragraph, mere passive association is not the whole factor. The organism has certain innate selective dispositions and association serves only to direct in a measure the basic organic activities which are motivated largely from within, as is the case with hunger, restlessness, excitability to moving things, etc. For example the writer tried to give a child nearly a year of age the idea 'moon.' The child was taken out of doors on an evening when the moon was full and nearly overhead. Attempts failed at first to get the child to attend to the moon, though the latter was pointed at persistently as the word was spoken. At this juncture a street car passed. The child's attention was attracted by the moving object with its brilliant lights. To the word 'light' which I spoke while pointing toward the car, the child responded by likewise pointing and saying 'ite.' When the car had passed similar responses were evoked to certain lights in the distance, and finally to the moon. The term 'moon' was now substituted, the child responding and attempting to say the word. After a number of repetitions of this kind the child would suddenly look up and point to the moon whenever the word was spoken by me. Afterwards when the child was in the house he would crawl to the window or door and look up for the moon, repeating 'moo! moo!' Finally on my appearance later he would frequently take the initiative in saying the word and in pointing out of the window at the sky. When taken out he would look all around for the moon. He had 'got the idea'; not, of course, exactly the idea that I had, but one—*i. e.*, a kind of response—consistent with his own more limited experience. Whether

or not he had the same imagery—visual, auditory, kinesthetic, etc.—that I had, or the same that any one of us would have had, is not important here. There is every reason to doubt such community of imagery in adults, to say nothing of community of affective states. Do two adults ever have precisely the same idea? This can be answered, if at all, only from their reactions, verbal or more overt acts, and depends in a large measure, too, on just the precise meaning given to 'idea.' For the present we have no interest in a mere academic discussion of this question; but for our practical purposes we may conclude that people have the same idea when they react overtly alike in all the essential details to the associated stimulus.

One is likely on safe grounds in holding that all ideas arise by a process in the main like that just illustrated in the case of the child, that is, that ideas are developed by the association of certain acts with given stimuli. But this association depends, as was suggested in the foregoing, upon inner instinctive tendencies and selective dispositions. It is of course admitted that when many ideas have been acquired by a child he may elaborate these and develop new ones by various combinations of those already attained, and by the substitution of one term already understood for another. That ideas come thus from experience wholly no one would likely now deny, though it could not be held by anyone that the mind begins with the passivity implied by Locke's *tabula rasa* conception. It is also to be noted here, to avoid misunderstanding, that in experienced individuals many of the responses here spoken of are not immediate overt acts. Many are more or less delayed, being impeded by others, sublimated into larger responses to almost inconceivable complexities. Allowing for such complications and indirect responses—provided that the instinctive dispositions of the subject are normal and that the fatigue effects and other physiological conditions are as before when the idea was acquired—I see no reason why an idea should not express itself in an act when the recurring stimulus 'brings it up in the mind.' Of course Thorndike's experiment failed to take note of these

other factors, and the words presented visually to his subjects were presumed to be the only stimuli operative! This is precisely the error that has persisted in the usual statement by writers in social psychology, that the child takes on the ideas of the race by suggestion, imitation, and so on.

Our point is that to make social psychology free from some of these errors we must get objectively at the nature of ideas, and must understand their origin. From this point of view an idea is a disposition to response, which is associated with a certain kind of objective stimulus, usually a spoken or a written word. Physiologically it is a stimulus-response mechanism whose neural connections are empirically established or developed, a mechanism which in the highly developed individual (or 'mind') becomes extensively particularized both as to the type of adequate stimulus and as to the nature of the response; *i. e.*, it becomes *freed* from other stimuli and responses usually associated with it in a larger complex.[1] This does not, of course, deny that in larger and more complex stimulus situations it may function in combination with other such mechanisms. In this sense comparative psychologists speak of 'free ideas,' which are usually denied to animals below man. An idea, then, is a sort of acquired, more or less detachable, stimulus-response disposition, or habit. In its most elementary aspect it may function in numerous combinations with other such habits, just as a given word may function in various contexts in a language.

Strictly speaking nothing is communicated when one person tells another something. Not even *meanings* are communicated, in this sense. The second person is stimulated auditorily—or visually if he reads the communication—and what he gets out of the stimulus is what his own experience or training has associated with the word-stimuli. This is obvious if persons of different language groups attempt to converse. They do not understand each other, and must resort to gestures that have approximately equal associations for the two individuals. They have not become accustomed

[1] In the reference given in the preceding footnote the writer has developed this idea more fully.

to the same word associations. Conversation in highly abstract and condensed terms is possible only to those with similar experience sufficient to make quickly the multiplicity of associations with previous acts or experience suggested. That is why education must always, if it is to be real and function successfully, keep close at first to laboratory experiments and to actual first-hand experience, and relax only gradually on these matters as the individual gets the necessary basis for the more symbolic procedure.

Why is it then that ideas are so persistent in generations, and that the older individuals get the new ideas with so much difficulty, if at all? Why is it that the social world changes so slowly? This is most easily understood if we think of the fact that for any important change to take place in society *both the stimulus-systems and the acquired habit-systems must change together.* Wholly new stimuli have no significance; they do not call out any definite response. New ideas must be *learned* just as more explicit acts or habits are learned by an interaction process. Habits are changed only as the necessities of organic needs demand, or as compelled by circumstances. Moreover, and of particular significance here, it is to be noted that, since all the members of the social group have acquired practically identical responses to the several stimuli, one person cannot begin new types of response to particular stimuli without conflict with his fellows. It is also impossible to change instantaneously and extensively the usual stimulating conditions. These difficulties are met, *e. g.*, in our attempts to simplify our spelling, or to get rid of our Fahrenheit thermometer scale. We cannot get rid of old books at once; hence our children must, on the one hand, be under a confusion resulting from the use of both kinds of spelling with the old predominating, and the adults, on the other hand, who have learned to spell in the old way, cannot easily fall in with the new. Only a few enthusiastic individuals, who have been influenced indirectly by certain scientific tendencies, act as the new stimuli to other individuals. Likewise with the thermometer situation and with the taking on of new kinds of tools and of improved methods.

The old materials cannot be at once destroyed without too much waste and effort, nor can the new habits be suddenly acquired by all. The new meets difficulties both of a physical and of a physiological nature. This dual aspect of change in social customs, beliefs, etc., has usually been neglected because of a too subjective treatment of ideas. It is instructive to imagine the inconceivably complex modifications required in any change of this kind. These difficulties are all obvious and concrete when we regard ideas objectively as acquired tendencies to respond in certain ways on the occurrence of given stimuli. This view does not, of course, deny in any sense the subjective aspect of ideas, imagery of various sorts, or their accompanying feeling states.

Looked at from this standpoint the so-called laws of suggestion become more intelligible—some of them less intelligible, if for intelligibility they must be true! A restatement of our suggestion psychology from this standpoint is most desirable. Some of its extravagances would be bound to disappear. The same thing is doubly true of that marvelous instrument of modern 'research,' the *sub-conscious*, or *co-conscious*.[1]

It is to be noted, then, that ideas are acquired by any social group in accordance with the stimuli which the group encounters, such, for example, as printed matter, spoken language, and various physical objects and symbols of significance. These ideas in turn, these habitual types of response, modify and further elaborate the various symbols and objective environment; and so a process of give and take between the individuals and the objective, standardized symbols develops into a civilization, a 'race inheritance.' Civilization is not only a matter of habits and ideas, but also just as much a matter of inconceivably complex organization of objective environment. The latter is intricately interwoven with the former both as cause and as effect. Each individual, moreover, is objective environment to every other;[2] and as different individuals overlap variously in their years of

[1] The two terms are not exactly synonymous, as currently used.

[2] This view is not incompatible with Cooley's view of society so penetratingly analyzed in his 'Human Nature and the Social Order.'

existence, some of all ages existing simultaneously, changes in ideas, customs, and conventions are difficult. Big crises bring changes about most easily *because they affect all individuals somewhat alike at the same time.* Thus a great war threatening a social group or a state may bring about important changes with surprising rapidity, as is seen in the present world conflict.

Giddings's 'consciousness of kind,'[1] as well as other subjective statements of perfectly obvious facts about society, is easily and more objectively and concretely explicable on this view. An individual reacts easily and with little friction in familiar environment, *i. e.*, to the interrelated groups of stimuli to which he is accustomed or by which he has been molded; but as he gets away from these stimuli, even though they are not wholly different from those in his own group, complications arise in his responses. This is true both of his overt acts and of his intra-organic processes. His acts become disorganized, uncoördinated, and aimless. Often they are inefficient to a high degree, while, subjectively, feelings of lonesomeness, of exaggerated self-consciousness and of discouragement arise, reflecting inner disturbances. Technically speaking it is not these *feelings* that return one to the group, nor the *consciousness of kind* that keeps one there. Such is only a superficial and popular view of the matter, one that results in vagueness of explanation and description and that renders inadequate means of social control and social modification. The difficulties of functioning and of general orientation in foreign social groups, with their new combinations of stimuli and the absence of old ones to which habits have been adjusted, are the important things to consider. The situation is such as to favor reaction back to the old familiar conditions. Imagine a person going into a foreign country where language, customs, the medium of exchange (money), etc., are strange. He not only fails in numerous ways to make the adjustments necessary for his own bodily and social needs, but he also thereby becomes marked as different from other individuals, as peculiar, and

[1] Giddings, F. H., 'Inductive Sociology,' 1901, 94 ff.

may bring down upon himself all the protective hostile reactions of the foreign group. Even a strange accent may do this; or, among groups speaking the same language, numerous provincialisms, habits, and evaluating responses, in which each individual is typical of the community that fashioned him, may serve as shibboleths. Preliminary studies of group-differences based on word-association reactions[1] and on certain intelligence tests[2] are about all that have been scientifically made by psychology in this field. In comparative psychology some studies have been made, in many cases more or less incidentally, on the reactions of certain mammals[3] and insects[4] to individuals of other groups chiefly on the basis of characteristic odors. The whole field suggested in this paragraph is practically untouched and is full of possibilities for empirical psychology.

Imitation and suggestion are no longer adequate terms by which to explain how a child takes on the language, customs, beliefs, etc., of the group into which he is born. In the first place such explanations imply too great passivity on the part of the individual. The child acts instinctively in numerous ways from the time of birth, or, more precisely, inner stimulating conditions and bodily needs bring about various acts which persist until the stimulating conditions are changed. The instinctive impulses are modified by a trial and error process and become adapted to the environment into which the individual is born. Many of them come into conflict with the acts of other persons. Impediments and inhibitions result in numerous more or less subtle ways, and as the child grows his acts naturally find expression and organization along lines of greatest consistency, or of least opposition and obstruction. Thus society results by means

[1] Woodrow, H., and Lowell, Frances, 'Children's Association Frequency Tables,' PSYCHOL. MONOG., 1916, No. 97. Group differences are only incidental features of the monograph.

[2] Several of the Binet-Simon tests in America have incidentally shown differences among various social groups.

[3] *E. g.*, Watson, in 'Animal Education,' 1903, found evidence of what he supposed to be reactions to sex odors, but which may as plausibly be interpreted, so far as his experiments go, as reactions to group differences on other than sexual basis.

[4] See Washburn, 'The Animal Mind,' 1917, 100 ff.

of the suppression through conflict of all habits and tendencies not suited to coöperation, and by the facilitation of acts mutually beneficial and objectively consistent.[1] It is obvious, *e. g.*, that in the acquirement of language and ideas by the child these factors play a larger rôle than usually supposed, and that passive imitation is not the important factor that it has been made out to be by such writers as J. M. Baldwin. Moreover, experiments on learning have shown, as is now well known, that new acts must be brought under control of proprio- and intero-ceptive stimuli by a random trial and error procedure, in which the fittest acts survive, before they can be called out so simply by the sight of others' acts. In the subjective terminology, one must get the resident (kinesthetic) imagery of new acts by trial and error and associate it with remote imagery before the acts can be controlled sufficiently for imitation. Even then imitation must have some adequate motivation.

The Freudian writers are right in putting their emphasis on instinctive and intra-organically initiated activity with consequent conflicts, repressions, sublimations, etc., whatever objection one may have to their over-emphasis of the sexual impulses and to such special explanatory machinery as subconscious 'censors.' Habits, as McDougall has insisted,[2] are formed in the service of instincts. The instinctive dispositions do not change and function differently just

[1] On this basis the repressions of the Freudians may receive a reasonable explanation. In an article entitled, 'Completeness of Response as an Explanation Principle in Learning,' PSYCHOL. REV., 1916, 23, 153–162, the writer has developed the view expressed above in its application to learning. Experimental support of the view is given in the monograph referred to in note 3 on page 217. In experiments with animals he has shown that frequency and recency laws actually do not explain the rat's learning in the maze, 'Frequency and Recency Factors in Maze Learning by White Rats,' *J. of Animal Behav.*, 1917, 7, 338–364. The completeness of response principle seems to be applicable to social adaptation. Responses to stimuli in social environment do not take place immediately as a rule, often not for long periods of time; in the meantime other stimuli are received, the effects of which overlap with those of the earlier stimuli. Responses, then, are along the lines most consistent with all the stimuli, or with the entire situation. These are the most complete in the sense outlined in the theory. This is what makes them usually pleasant, the greatest consistency with organic needs and the external situation. Facilitation of the nerve impulses along certain tracts thus arise, and useless acts are gradually eliminated.

[2] 'Social Psychology,' p. 43.

because one sees other individuals perform certain acts; changes in all our habits and ideas come only as they are forced by the maladjustments of one's instinctive equipment, and such changes in turn modify the various symbols by which ideational responses are brought about. Individual innate differences are of course important in these processes of mutual adjustment between individual and environment.

THE ATTRIBUTES OF SOUND[1]

BY R. M. OGDEN

Cornell University

My special interest in the attributes of sound began, I think, in 1903, when, through association with Professor Max F. Meyer, I became familar with his important work in audition. Up to this time I had accepted the traditional account of the attributes of sensation as being four in number: quality, intensity, extensity, and duration. When applied to sound this view identified pitch with quality, while extensity was represented by a vague concept of volume. Meyer in his paper 'On the Attributes of Sensation'[2] impressed me with the notion that there need be no *a priori* assumption that all sensations should have the same formal attributes. I also learned at this time of Meyer's distinction between *quality* and *pitch*. The former he referred to *height*, in the sense that every sound has its characteristic place in a progression, best described as a variation from mellowness (lowness) to shrillness (highness). A sound may also have pitch, *i. e.*, musical relatedness. In this case it is a *tone*. The attributes of sound, as given by Meyer, were four in number: duration, intensity, quality, and pitch. Extensity disappears. Whatever there may be of voluminosity is absorbed in quality. But Meyer's attributes are not the independently variable aspects of a sensory content. Rather, they are like atoms of consciousness that can be judged or compared with the aid of attention. Noise lacks pitch altogether, for it cannot be used musically. Objection can here be raised because pitch as so described is a *meaning*: it is musical significance, what else it may be does not appear.

Meyer stated in his paper that 'the average psychologist

[1] Paper read before the American Psychological Association at Pittsburgh, Dec. 27, 1917.

[2] Psychol. Rev., 1904, 11, 83–103.

takes . . . little interest in auditory sensation.' This seems to have been true, for Meyer's contribution to the scientific description of sound exerted but slight influence upon psychologists until they were confronted with the more startling results of Köhler, Révész and Jaensch. Then, at last, such an interest began to awaken. Révész[1] in particular discovered a remarkable pathological condition in the hearing of his friend and collaborator v. Liebermann. The latter proved to be unable to judge fusions and musical relations correctly in certain regions of the scale, although his sense of interval-distance was unimpaired. This led Révész to a distinction in the pitch attribute analogous to that which Meyer tells us he got from Stumpf, and made public as early as 1898. But Révész reverses the terms: quality becomes his designation for musical relatedness and fusion, while pitch becomes brightness-height or dullness-depth. In the interest of a uniform terminology, Meyer[2] has recently suggested that the first attribute be called *tonality* and the second *vocality*. But these terms, as we shall see, embrace too much. Besides they are still open to the objection that they incorporate meanings into the structure of sensation.

Watt has now subjected the whole matter to a critical review that culminates in the presentation of a comprehensive theory of the psychology of sound. This he incorporates in a recently published volume.[3]

Watt returns to the traditional classification of the attributes and attempts to establish a uniform list applicable to each of the senses. It is through integrations of these attributes, he believes, that all conscious processes arise. By way of certain uniformities we arrive at the unity of consciousness in which the various sense modalities figure. The attributes he suggests are quality, intensity, 'systemic order,' extensity, temporal order and durance. Quality signifies the essential nature of the sensation, as cold, warm, red, bitter. In the realm of sound there is but one quality,

[1] *Zsch. f. Psychol.*, 1912, 63, 263ff., 325ff.
[2] *Zsch. f. Psychol.*, 1914, 68, 115ff.
[3] H. J. Watt, 'The Psychology of Sound.' Cambridge, The University Press, 1917.

though there are three important integrations: tone, noise and vowel. Intensity requires no special comment as to its meaning. 'Systemic order' underlies all localizations and positions. In sound it is what we call pitch. Extension is the attribute of 'spreadoutness;' in sound this is volume. Temporal order is the basis for comparison of units in time, as evidenced in rhythm, while durance is mere protensity, or the temporal spread of sound.[1]

With regard to tone, Watt urges that this is always a massive phenomenon. The volume of a tone embraces a number of 'systemic orders,' one of which, rising to prominence, marks its pitch. The rise of this predominant order, together with the others included in the volumic whole, measures the tone's intensity. The 'systemic orders' incorporated in a sound are of great importance in determining fusion and sequential integrations. It is in this way that Watt explains musical effects. The predominant order, or pitch, is normally central to the tone's volumic outline. Volumes decrease regularly in size as pitch increases in height. Hence, when two tones in the octave relation are simultaneously sounded, the upper tone will fall entirely within the volumic outline of the lower tone. Furthermore, the order of the higher tone's pitch predominance will be such that it occurs midway between the lower tone's predominance and the upper limiting order of its volumic outline. The upper limiting orders of volume for all tones coincide, because two tones simultaneously heard never stand apart, but always interpenetrate. In the case of the octave "only one natural pattern offers itself as obvious: that in which the extreme order included in the volume of the higher tone on its lower side coincides exactly with the predominant order of the lower tone."[2] On this ingenious foundation Watt constructs his theory of fusion and musical interval as resting upon a balance of the resultant sound mass when one sound coalesces with another. (See Fig. 1, p. 238.)

[1] "To distinguish temporal order from the order upon which localisation rests," writes Watt, "the latter may be called systemic, as it is the order that appears when a system of receptors yielding one quality is given." *L. c.*, p. 9.

[2] *L. c.*, p. 64.

Coming to Watt's interpretation of v. Liebermann's case, we find him suggesting that the pathological condition is in reality a shifting of the pitch predominance away from its normal central position in the volumic mass. Hence, the fusional balance is destroyed, although the volumic outlines remain as usual. V. Liebermann judges his distances correctly. He knows that the octave span is greater than that of the fifth, yet he cannot always detect a fusional difference between them.

Although adequate experimental evidence for Watt's theory is lacking, it must be noted that such results as we have are rather in line with his proposals. Dr. G. J. Rich, for instance, who has experimented on volume discrimination, finds it to follow the geometrical progression of Weber's Law. His recent investigation with pure tones, which I am privileged to cite, indicate the limen to be approximately 6 vib. in the region of 275; 12 in the region of 550, and 24 in the region of 1,100. The fractional increment is thus about .02. This uniformity suggests that the volumes of tones in octaves are halved in size as one proceeds upwards in the scale, which is the conclusion Watt reaches on theoretical grounds.

The difficulty of Watt's theory does not rest on an assumption of volumic coincidence so much as in the 'symmetry' and 'balance' inferred in the case of all fusions. This is his explanation of fusion: that two tones fuse when the volumic pattern of the higher one balances with, or is symmetrically placed within, the volumic pattern of the lower. For such emplacement the decisive factors are the terminal limits of the two volumes, but these limiting orders must be consciously and physiologically negligible. Strictly speaking symmetry is only found in the octave, and a true balance only in the fifth. Other fusions seem to rest upon accommodations resulting from a sense of proportionality with regard to the intervals employed. Note, for instance, the graph of the *fourth* in Fig. 1. The balance is here disturbed because the predominant order of the higher tone is twice as far removed as is its lower limiting order from the predominant order of the lower tone.

My own reaction to this matter is determined by a different point of view. While Watt attempts to overcome the difficulties of a purely structural psychology by working out an elaborate system of integrations among the attributes of sensation, I am disposed to a functional interpretation, in which I accept mental acts as distinct from mental contents. The attributes that constitute a sensation are basic facts upon which the mind operates, but the operations themselves are not inherent in the attributes. Neither fusion nor musical relatedness, I think, can be adequately accounted for without reference to an *attitude*. The attitude is dispositional and embodies tendencies to conscious response: directions and determinations that have their origin apart from the attributive nature of the tones fused or related.

The revision of the attributes of sound that I am about to suggest is based upon this functional point of view. Since I leave much to *cognition* as a function, I do not find it necessary to incorporate among the attributes all that Watt deems requisite. Nor do I find it theoretically important that a uniform set of attributes should be equally applicable to all the sense modalities. Yet mental functions can operate in the first instance only upon what the sensations offer. If mental acts are capable of creating mental contents, as I believe them to be, such contents are of a different order, namely, the thought contents. While thought is qualitatively distinct from sensation, as a complex of attributes within a certain modality, still it is from comparisons instituted among the attributes that these derived contents of thought or meaning come into existence. Hence their creation does not occur in a world apart from that of sensory experience. They are founded in it and upon it.

The attributes of sound as I find them are not primarily determined with a view to system, but are describable facts of consciousness. In this instance my findings have been largely gained from participation as an observer in the experiments performed last year in the Cornell Psychological Laboratory by Dr. Rich. But I hasten to add that the interpretation I place upon my own experiences, as well as upon

the general results of the experiment which Dr. Rich kindly placed at my disposal, is my own, and in no way implies concurrence on the part of Dr. Rich.

In listening to a pure tone I was impressed by the pitch predominance of which Watt speaks, and also by the surrounding aura of volume. I also felt that I could detect differences in *emergence* of the pitch salient from its surrounding volume. This latter effect I designate as *brightness*. These seem to me to constitute three attributes of sound: pitch, volume and brightness. In addition, intensity is clearly attributive, as is also durance. Of these, brightness finds no place in Watt's list, and I must admit that I have no evidence of a correlative uniformity in vibrational frequency, as I have in the case of pitch and volume. How brightness is dependent on frequency and amplitude I do not know. In the main, brightness increases with rise of pitch and decrease of volume, it therefore seems to depend on these two attributes; but intensity may also be involved. Pending further investigation, I am content to accept it provisionally among the attributes because of its descriptive differentiation from the rest. As for Watt's two temporal attributes, one suffices me, because I regard temporal order as a functional effect, partly meaningful, in which kinesthesis probably plays an important rôle.

The attributes of sound here advocated are, then, pitch, volume, intensity, duration, and, tentatively, brightness. A graphic representation will perhaps aid in distinguishing these. (See Fig. 2.) In this minaret-shaped solid the pitch is indicated by the salient peak, while the volumic spread is suggested by the solid form as a whole. The rise of the total mass from its circular base represents intensity. Brightness is the emergence of the salient from the volumic mass. Another figure (see Fig. 3) gives two forms representing like pitch, volume and intensity, but varying brightness. In the first form the salient emerges more clearly than it does in the second. Duration, finally, is mere persistence of the sound in time; dependent upon fluctuations of the stimulus, the physiological response and the attention, providing the basis for rhythms, periods and the like.

Watt also includes quality as an attribute, though he admits but one invariable quality of sound. If a sensation is the sum of its attributes, then quality must be one of them, even at the expense of independent variability. But I prefer to regard the substantial essence of sensation as a fundamental class or modality, rather than as an attribute. I agree with Watt that there are three kinds of sound: tone, noise and vowel, but while he regards these as results of integration, I would refer them to functional interrelationships. Although the attributive nature of the sound determines to a large extent whether it shall be regarded as a tone, noise or vowel, intrinsically it is lacking in any such definition. The act of relationship introduces order. By comparison I determine one pitch to be higher than another, one volume to be greater than another, one tone brighter than another, more intense, or of longer duration. I prefer, then, to speak of three *characteristics* of sound: tonality, vocality and noisiness, rather than of three integrations, or of three attributive qualities.

Tonality is a characteristic of those sounds that can be fused or musically related. It rests primarily upon pitch and volume. As pitch varies from high to low it affords a means of comparison with respect to serial order. But it is not pitch alone that gives rise to musical order. Very high sounds, even when produced by regular periodic vibrations, are notably lacking in tonality. Although differences in height are still evident, volume differences are so vague, owing to their smallness, that they cannot be readily compared. In the lowest range of sound we meet with a similar difficulty, but the reason is not the same. Here volume dominates, and pitch does not emerge sufficiently to define the tone. As all high sounds are too bright, so all low sounds are too dull to lend them the characteristic of tonality. The mind can act in certain ways upon sounds whose pitch and volume are defined. This activity of the mind is musical, and it depends upon the definition of tones. Hence tonality is a characteristic of sounds only when they imply a musical setting. This activity rests chiefly, I believe, on two principles of

correlation. The first is the principle of harmonic interval, and the second that of equal interval, or proportional division.

By *interval* I mean the distinction of two tones whose pitch and volume are both clearly differentiated. This is tonal definition. It is introspectively evident that pitch difference alone does not constitute an interval. Pitch distinction is possible with less than one vibration difference in the stimuli of two tones. As is well known, the liminal increment tends to follow an arithmetical series. One may distinguish with equal ease tones of 250 and 251 vibrations, and tones of 500 and 501 vibrations. Rich has shown[1] that this is not the case with volume. Volume distinctions are not so fine, and they follow a geometrical progression of vibrational frequencies. Thus while the octave of 250 to 500 vibrations would contain more than 250 discriminable differences of pitch, it would contain, from Rich's estimates, but 25 to 50 discriminable volumes. Furthermore, with slight variations of pitch we note no change of tonality. Only when a clear volumic difference is evident does an interval seem to occur.

As regards the origin of the principles upon which tonality may be said to rest, that of harmonic interval obviously suggests the series of partial tones. The common musical setting of the octave is in part due, I think, to the dominance of this interval among the audible partials. The fundamental dominates its overtones. The first interval in the series, as well as the one most frequent among the partials, is the octave. Hence the octave as a special function of relationship may be said to obtain prominence because of the frequency with which the ear must act upon this relation of tones. It may be objected that there are tones in which the even-numbered partials are not conspicuous, but these are rather unusual. A more serious objection is made by Stumpf, who does not admit that frequent association can produce so fundamental an effect. Answering this we have the results of Moore[2] and Valentine[3] to show that adaptation does facili-

[1] Cf. J. of Exper. Psychol., 1916, 1, pp. 13ff.
[2] Psychol. Monog., 1914, 17, no. 73.
[3] *Brit. J. of Psychol.*, 1913, 6, pp. 190ff.

tate functioning. It appears that one can readily learn to change the effect of a not too dissonant into a consonant interval. Still one must rely on something more fundamental than musical practice to explain fusion. I have therefore previously suggested that racial adaptation is also probable.[1] Assuming a certain ease of functioning in the case of the harmonic intervals, it is possible to understand the readiness with which one might be able to detect the differences of timbre that characterize the more significant noises, voices, and clangs of nature. Hence, the most frequent intervals of the partial series may have a certain survival value, because facility in their functioning would thus open a way for recognition of constituents that are not readily fused. V. Hornbostel[2] has sharply criticized my views on the ground that among primitive peoples noises and inharmonic intervals are much more prevalent than tones. But I do not see that this need prevent a gradual evolution in refinement of adjustment and judgment. The facility of harmonic intervals might be of use in perception long before it became a basis for music. Furthermore, we have not one sole principle of tonal order, but two to reckon with. In addition to harmony, there remains the capacity for proportional divisioning of which primitives, especially, make great use.

Granted the octave, however it be founded, the question of smaller intervals is solved in two ways. One is by the harmonic principle in accordance with which other conspicuous intervals of the partial series are the important bases of division: thus, the fifth and the fourth, particularly, lead to the diatonic scale of whole and half tone intervals. The other is the principle of proportional division whereby the octave is divided into a certain number of *equal* intervals, irrespective of harmonics. Hence we find such scales as those of Siam and Java, the first with seven, the second with five equal intervals. Stumpf's investigations[3] leave us with no doubt as to the natural origin of these scales. Even

[1] PSYCHOL. BULL., 1909, 6, pp. 297ff.
[2] *Zsch. f. Psychol.*, 1912, 61, p. 70f.
[3] *Bericht v. d. IV. Kongress f. exper. Psychol.* Leipzig: Barth, 1911, pp. 256ff.

though the divisioning may have been originally influenced by the dominance of the fourth and fifth, as Watt thinks probable,[1] this would only explain the number of steps to be provided in the octave, for these scales have evidently been worked out with a careful regard for equally tempered intervals throughout.

Thus we see that certain Oriental music is more intent upon equal than it is upon harmonic intervals. And this is quite possible, because equal proportions and their multiples are as readily distinguishable as are harmonic intervals. So long as music remains essentially a melodic sequence without musical accompaniment, the harmonic intervals, which alone permit fusion, are not requisite. The melodies of equally tempered scales are atonic, but although they lose the tonic dominance of harmonic organization, they gain freedom in transposibility. It is difficult for us with our very different traditions and usages to appreciate such music, yet I think it quite certain that those who are familiar only with naturally tempered scales find real and logical delight in the employment of intervals that are based upon simple multiples of a common unit.

It seems evident that this principle of proportionality has its origin in the proportional decrease of volumes. Yet it would be incorrect to regard pitch as negligible, for pitch secures to the tone its characteristic salient, and thus contributes expressly to its definition. Volume alone defines the interval in an atonic, no more than it does in a diatonic sequence. While volume difference makes intervals possible, it remains for the mind to choose appropriate functions in determining a specific tonality or musical setting. The main choice is between dominance by the 'harmonic chord of nature,' the partial tone series, or by a simple division of the octave into any small number of equal parts. In either

[1] *Cf.* l. c., pp. 135ff. The interval of three whole tones in the Siamese scale is $514\frac{2}{7}$ 'cents,' as compared with 498 'cents' for the true interval of the fourth. Four whole tones in this scale give $685\frac{5}{7}$ 'cents,' as compared with 702 'cents' for the true fifth. The discrepancy in each case is $16\frac{3}{7}$ 'cents.' Comparisons between similar intervals of the Javanese scale show discrepancies in each case of 18 'cents.' The greatest discrepancy between notes of the tempered diatonic scale and those of the scale in just intonation occurs with the sixth, where it is 16 'cents.'

case the octave furnishes the framework, the basic attitude or disposition, upon which these functions must operate. Wherever there is tonality, there is read into the tone an octave setting.

While I have advocated the theory that the octave owes its origin in part to the harmonic series, I am not sure that this is its sole foundation. Although I have criticized Watt's theory of 'balance' as an explanation of all music, I think it not unlikely that the proportional decrease in volume by halves with octave frequencies may be of fundamental importance in lending to this particular interval its outstanding position. Goebel,[1] too, has advanced a theory that bears upon this matter. It is to the effect that in sounding any tone with sufficient intensity, another that is an octave below it is also involved. He believes that portions of the same resonator in the ear act together in producing the two sounds. Hence octaves are subjectively inherent in tones. However this may be, the fact is at least evident that octaves are the most fundamental of intervals, and all effects of tonality relate to them.

While tonality results from the fusion and musical relatedness of intervals, vocality is that characteristic of sounds which defines vowels. As the investigations of Jaensch have shown,[2] vowels are sounds of *regional*, but not of salient pitch. A number of vibrational frequencies varying but slightly from one another unite to occasion the sound we call a vowel. The researches of Köhler,[3] Miller,[4] and others have shown that the chief vowel sounds (continental usage) fall in the order *u*, *o*, *a*, *e*, *i*, each being characterized by a regional pitch beginning around 264 v.d. for *u*, and proceeding upwards by octave steps for each of the others. The significance of these special regions for the outstanding vowel sounds leads Stumpf[5] to suggest the possibility of specially marked *C*-

[1] *Zsch. f. Sinnesphysiol.*, 1911, 45, pp. 109ff.

[2] *Zsch. f. Sinnesphysiol.*, 1913, 47, pp. 219ff.

[3] *Zsch. f. Psychol.*, 1910, 58, pp. 59ff.

[4] D. C. Miller, 'The Science of Musical Sounds.' New York: Macmillan, 1916, pp. 215ff.

[5] *Bericht v. d. VI. Kongress f. exper. Psychol.* Leipzig: Barth, 1914, p. 322f.

Fig. I.

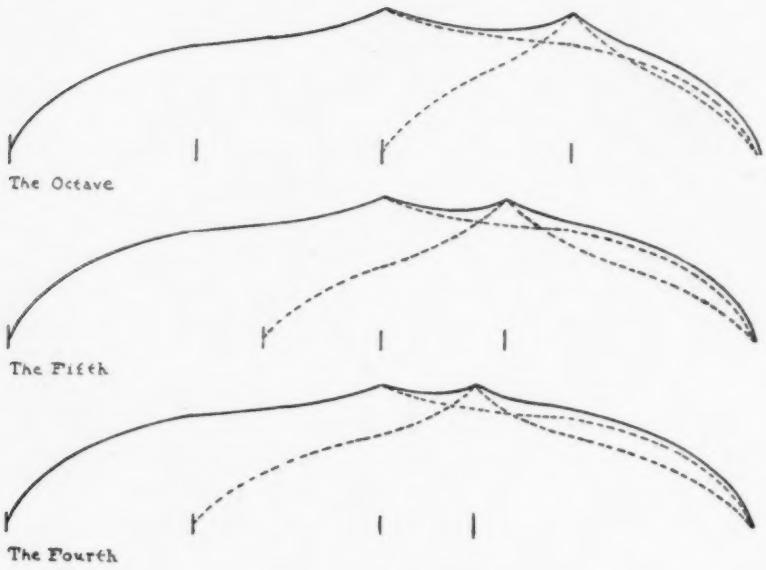

Fig. II

Fig III

Fig IV

Fig. V

FIG. 1. Watt's Conception of Fusion.
FIG. 2. Graphic Representation of a Tone.
FIG. 3. Graphic Comparison of two Tones differing in Brightness.
FIG. 4. Graphic Representation of a Vowel.
FIG. 5. Graphic Representation of a Noise.

qualities in the tonal series. Watt,[1] however, remarks that if we but assume some special facility in the articulation of a single regional pitch of this series, the rest would be likely to follow in this order because of the dominating influence of the octave law.

The graphic form of the vowel is indicated in Fig. 4. Pitch is not altogether lacking, but it has no salient of brightness. The sound of the vowel is smooth, for pitch is submerged in the volume. Comparatively, pitch is still distinguishable as an average or regional effect, and, optimally, is that pitch which would be central to this volume if it had a marked salient. The true vowel is not necessarily the only element in a vowel utterance, for Miller has shown[2] that with the higher vowels, *e* and *i*, a pitch predominance of a lo ver order may be present in even greater intensity than is the region of resonance characteristic of the vowel. Yet when the upper region is eliminated, the sound changes to that vowel characterized by the lower region of resonance.

Noisiness, finally, is the characteristic of sounds in which neither a definite salient nor a regional pitch is in evidence. Noises are irregular sound phenomena, and the occasions of such irregularities are numerous. If one increases unduly the range of adjacent frequencies employed to produce a vowel, the sound will gradually take on the character of a noise. If one does not increase the range enough, the sound remains a tone. The ability to bring together adjacent pitches into a definite regional or vowel effect is therefore limited to a certain range of adjacent frequencies. But noise may also occur through the combination of several tones of outstanding pitch. This happens when the combined tones cannot be ordered in accordance with the harmonic principle, *i. e.*, when the constituents do not fuse. Eight notes in the sequence of the major chord fuse into a tonal effect, but eight adjacent notes of an octave, when simultaneously struck, are noisy. In addition we have the noisy effect of incomplete vibrations whose periodicity is confused. Sudden changes

[1] *Brit. J. of Psychol.*, 1914, 7, p. 12f.

[2] *L. c.*, p. 223f.

in intensity, brightness, duration and volume also contribute to such confusion. Indeed, any irregularity that the mind is incapable of mastering by its usual functions of harmonic fusion is an occasion for noise. This includes the noisiness of very high and very low sounds, even though their vibrational frequencies are quite regular. A graphic representation of this condition is offered for comparison with those already given, though it suggests but one among numerous types of noise. (See Fig. 5.)

Although indefiniteness of either pitch or volume is the occasion of noise, Köhler has pointed out[1] that sounds of the high and low regions are not lacking in individuality. For it is here that we find certain of the consonants: *m* sounds are characteristic of the low, and *f*, *s* and *ch* sounds of the high regions. It is also probable that definite blendings of the attributes are responsible for all the other consonants, as well as for a wide range of characteristic and easily recognizable noises.

My conclusion is, then, that within the modality of sound there are to be found the following attributes: pitch, volume, intensity, duration, and probably brightness. With the aid of appropriate mental acts, or functions, the presence of these variables in a sound leads to certain orderly arrangements and usages, resulting in the characterization of sounds as tones, vowels, and noises. While the attributes are revealed from the standpoint of a detached description of structural content, tonality, vocality and noisiness are meaningful implications of reciprocal interactions between mental functions and conscious structures. Lack of functional capacity explains *amusia*, and also some forms of speech deafness. Music, oral speech, and significant noise are all results of comparison and judgment, in which the structural elements of sensory content furnish the basic data.

When the sound possesses a dominant pitch and a definite volume it may be fused and related with other sounds of like nature. It thus acquires the character of tonality. When it possesses regional pitch and regular volumic proportions,

[1] *Zsch. f. Psychol.*, 1913, **64**, pp. 92ff.

but no salient, it becomes a vowel. Because the larynx and mouth cavity are capable of producing such regular and characteristic sounds, they have been seized upon as important elements in vocal language. When, finally, the sound is irregular as to pitch and volume, it is described as a noise. But although noises cannot be treated in the octave setting, they are often capable of reduction to characteristic units, recognizable by their individuality as significant vocalizations —the consonants—and likewise as familiar objects of nature.

THE INTENSITY FACTOR IN BINAURAL LOCALIZATION: AN EXTENSION OF WEBER'S LAW[1]

BY G. W. STEWART AND O. HOVDA

University of Iowa

That the ratio of the sound intensities at the two ears is a factor in the localization of the sound source is well known. A number of experimenters[2] have reported investigations in which this ratio was varied and the localization observed, but none of them have attempted quantitative measurements. Previous experiments of the writer[3] on binaural beats indicated that the ratio of intensities when a pure tone is used was not an important[4] factor in binaural localization. This indication was not in harmony with the generally accepted view as to the importance of the intensity ratio, and hence quantitative measurements seemed advisable. This article will be confined to a presentation of these results. The factor of phase difference will not be discussed.

The Method.—The experimental procedure was based upon the belief that a knowledge of the importance of the intensity ratio as a factor in binaural localization should be sought, in the first instance, by the use of simple tones. The results of this paper are for a single frequency, 256 d. v., and the conclusions drawn would furnish only the first step in a complete investigation.

The Apparatus.—The frequency was selected by the circumstance that we already had in our possession a sensitive

[1] From the Physical Laboratory of the University of Iowa. We wish to acknowledge our indebtedness to Mr. Eugene Berry for his assistance as observer.

[2] Tarchanoff, *St. Petersburger med. Wochenschrift*, 1878, No. 43, 353–354. Steinhauser, *Phil. Mag.*, Ser. 5, 1879, 7, 261–274. Urbantschitsch, *Pflüger's Archiv*, 1881, *24*, p. 579. Kessel, *Arch. f. ohrenheilk.*, XVIII., 1882, p. 120. Matsumoto, Studies from the Yale Psychological Lab., 1897, No. 5. Stenger, *Zeitsch. f. Ohrenheilk.* XLVIII., p. 219. Rayleigh, *Phil. Mag.*, 1907, 13, p. 217. Ferree and Collins, *Am. J. of Psychology*, 1911, 22, p. 250. Numerous other writers refer to the subject.

[3] Stewart, *Phys. Rev.*, 1917, 9, 502–528.

[4] Rayleigh, *loc. cit.*, shows that it cannot be an important factor for 128 d. v.

Rayleigh disc[1] made and adjusted for 256 d. v. per second. The source of sound was a tuning fork of this frequency. Two sounds, one for each ear, were conducted from the fork by glass tubes, rubber tubing and binaurals, which, in a portion of the experiments, were inserted in the ears.

In order to obtain as pure a tone as possible and yet to maintain the vibration of the fork by electrical means, the common device of two forks in tandem, as shown in Fig. 1,

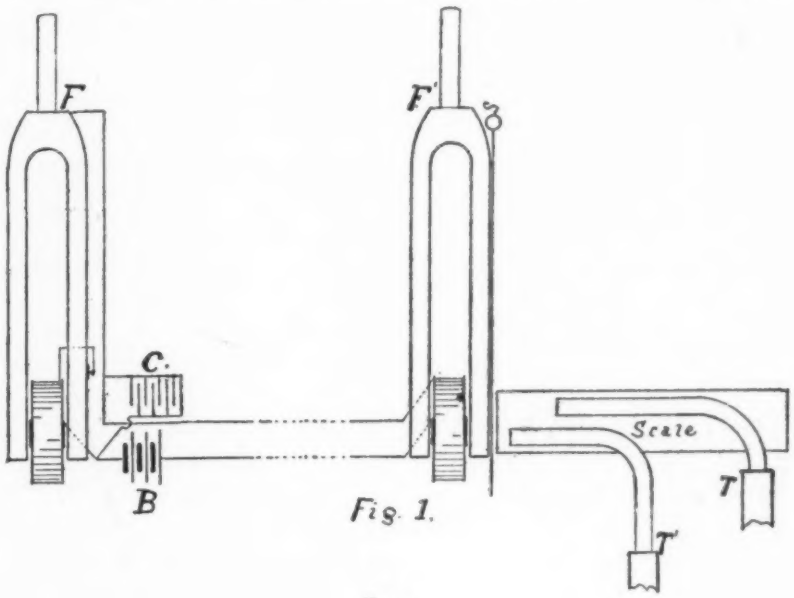

FIG. 1

was used. The auxiliary fork, *F*, carried the electrical contact and the circuit was completed by the battery and two magnet coils, one for each fork. Two glass tubes were placed in the plane of vibration at the side of one prong of the fork, *F'*, used as the sound source. One of the tubes was stationary and the distance of the other from the fork could be altered. Thus the flow of energy into one tube was modified at will and the relative intensities made any selected value within the range of the apparatus. The screen, *S*, could be inserted

[1] This disc is described in an article by Stewart and Stiles, *Phys. Rev.*, N. S., 1913, 1, p. 311.

and removed from the space between the fork and the end of the glass tubes. The terminus of the glass tube, T', was permanently fixed at a distance of 1.02 cm. from the fork and the position of the terminus of the other glass tube was varied from 0.20 cm. to 2.20 cm. from the fork. The sound was led from the glass tubes to the binaurals through approximately 3 meters of rubber tubing in each branch. The relative intensities or fluxes of energy in the binaurals were tested by the Rayleigh disc. Into the open end of the disc was inserted a stationary glass tube which will be called the 'disc tube.' Comparative measurements of the flow of energy through either binaural could be tested by connecting the binaural to the disc tube by a short rubber tube. The deflections of the disc were small enough to be considered as proportional to the intensities.

Binaurals constructed in order to avoid contact in the external meatus are shown in Fig. 2. *B* is a piece of thin

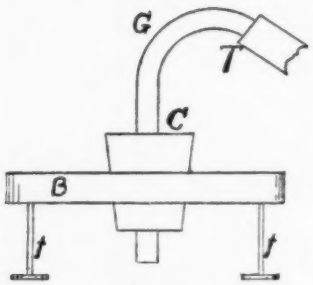

FIG. 2

triangular board, carrying at the corners three feet, *f*, which rest upon the skull. The sound enters through the rubber tubing, *T*, and passes through the glass tube, *G*, the end of which can, by adjustment in the cork, *C*, be placed near the opening of the ear. The real advantage of the binaurals is not that they completely isolate the skull, but that they present the sound to the ears without closing the external meatus. Nevertheless, the sound conveyed by the feet to the skull is vanishingly small and without influence.

In a part of the experiments the binaural observer was in the same room with the forks, but when the non-contact

binaurals were used the observer was in an adjacent room, in which the sound from the forks was sub-liminal. In front of the binaural observer was placed a chart marked with radial lines representing angular displacements from the median plane. The second experimenter was stationed at the sound source, and had the duty of varying the intensity of sound received at one ear by altering the distance of the adjustable tube at the fork. By resistance adjustment he also kept the amplitude of the fork approximately constant, this being a precaution to avoid any large variations in the flux of energy from the fork.

In each set of experiments fifty different values of intensity-ratio were used. In order that these values might be properly distributed in a given set the desirable displacements of the tube were chosen and these arranged 'at random.' The binaural observer was thus wholly without any information that would influence him in favor of a certain angular displacement.

Several assumptions and approximations were made in the arrangement of apparatus and the interpretation of results. They are as follows:

1. It was assumed that, for a given adjustment, the intensity-ratio of the stimuli at the two ears is the same as the ratio of intensities produced at the Rayleigh disc. The assumption seems to be entirely warranted.

2. It was assumed that the vibrations produced at the ears were alike in phase. This is only approximately true. The adjustable tube at the fork was displaced not to exceed one centimeter from its mean position. Thus the maximum change in phase produced by the altered length of path was less than 3°. Since former experiments with change of phase[1] indicates that the angular displacement in localization by a difference of phase is of the same order as the phase difference itself, one can be confident that the error of 3° does not modify the conclusions of our experiments.

3. In the interpretations of the results it is assumed that our method of producing intensities at the ear is physically

[1] G. W. Stewart, *Phys. Rev.*, 1917, **9**, pp. 502–508.

equivalent to that of moving a source of sound about the head, with the important difference, however, that in the method used the phase difference is negligible. This assumption disregards any effect produced by the impinging of waves upon the skull, which would occur in the case without binaurals. But experiments with the external meatus carefully

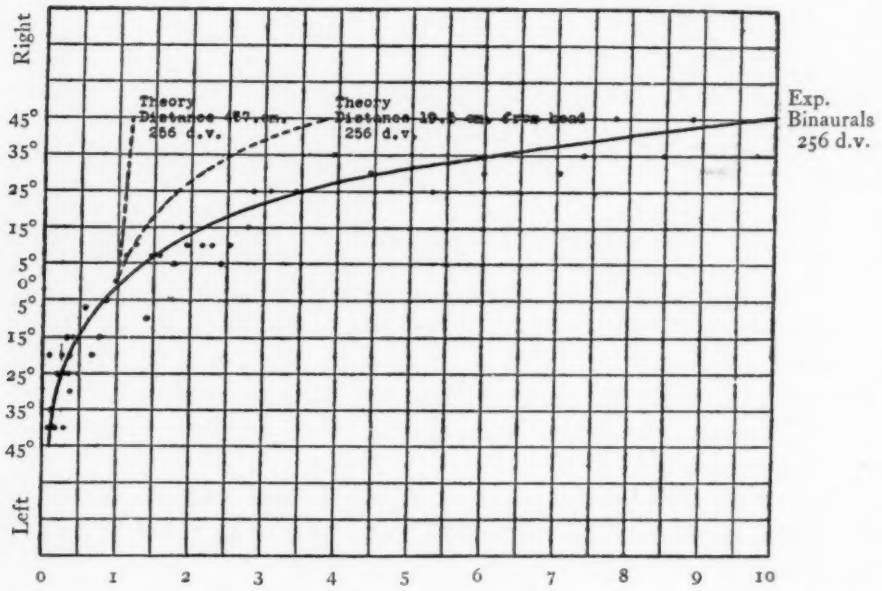

FIG. 3. Relative intensities.

stopped proved that the intensity of sound conveyed from the skull to the drum-skin under such circumstances was subliminal.

The Results.—The results first to be mentioned are those made with ordinary stethescope binaurals. The screen at the fork was opened for one or two seconds only, the operation being repeated with silences of perhaps one second each until the binaural observer indicated in some manner that he had arrived at an opinion concerning the apparent angular displacement from the median plane. In Fig. 3 the observations of one set are shown by dots and the mean results by the full-line curve.

The ordinates represent the apparent angular displacements from the median plane of the source of the blended sound and the abscissæ the ratio of intensities of the stimuli at the ears. The values last named we obtained from a knowledge of the distances of the movable tube as shown in the scale, Fig. 1, and a calibration curve taken with the aid of the Rayleigh disc. This curve was obtained by repeated measurements of the relative intensities with various distances on the scale, Fig. 1. The calibration measurements and curve are omitted, inasmuch as they will not be discussed in any manner. The error in the knowledge of any actual intensity-ratio does not exceed five per cent. and is usually much less.

The most striking result given by Fig. 3 is the relatively large change in intensity necessary to produce displacement in localization. The intensity at one ear had to be ten times that at the other in order to produce a displacement of 45°. This is surprising, for an intensity-ratio as great as 10 to 1 at the ears never occurs in our common experiences. By way of comparison, let us ascertain what values of intensity-ratio would be actually obtained by displacing a source of sound 45° from the median plane. For such values we are dependent upon a theoretical investigation,[1] in which were found the relative values of intensities at various points of a rigid sphere 60 cm. in circumference, with the source at several distances, r. In order to utilize the results of the theoretical investigation, we may select two points diametrically opposite on the sphere and assume the source to be carried about the sphere in a plane containing this diameter. From Fig. 2 of the reference just cited, it is possible to get the values of the intensities at these diametrically opposite points for a source of a wave-length 120 cm. (or, nearly enough), the frequency here used at distances of 477 cm. and 19.1 cm. from the sphere. It is a simple matter then to take the ratio between these intensities for any angular displacement of the rigid sphere corresponding to the apparent angular displacement observed and shown in Fig. 3. The dotted line curves in

[1] Stewart, *Phys. Rev.*, 33, p. 473.

Fig. 3 show these computed values of intensity-ratio and thus can be assumed to represent approximately the ratios of intensities at the ears with a source of sound 256 d. v., at distances of 477 cm. and 19.1 cm. It is apparent that with a displacement of 45°, the change in the theoretical ratio of intensities is 20 per cent. and 300 per cent. for the distances

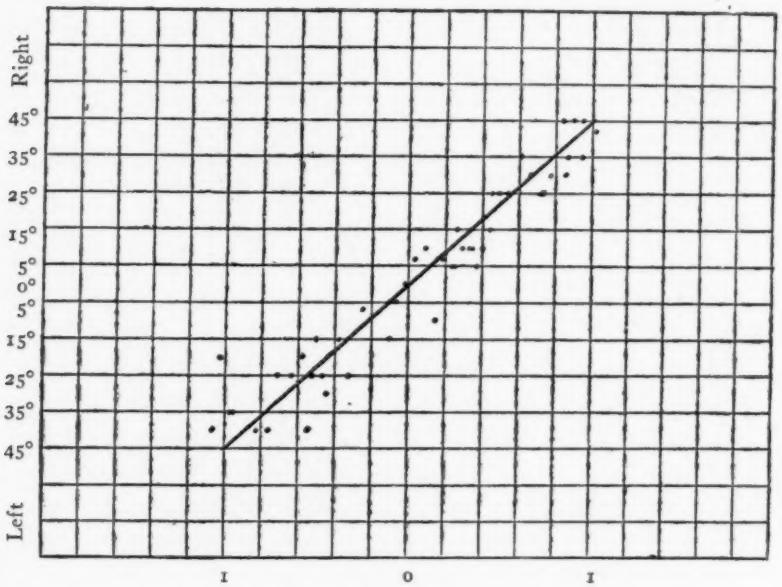

FIG. 4. Log of relative intensities.

from the center of the head of 477 cm. and 19.1 cm. respectively. But in our present experiment the change in the ratio required to produce apparently this same displacement is 1,000 per cent. It is perhaps fair to compare our present experimental intensity-ratio with the theoretical values obtained when the source of the same frequency is placed at the not unusual distance of 477 cm. We have then to compare an experimental change of intensity-ratio of 1,000 per cent. with the theoretical of 20 per cent. The comparison shows that the localization of a simple tone of 256 d. v. cannot be due to the intensity-ratio, for a change in ratio of 20 per cent. as shown by these experiments, would produce an ap-

parent displacement of less than 4°. But our experiments deal with intensity changes *only*. Hence our conclusion is that the intensity factor alone is of relatively small importance with a simple sound source. The work 'relatively' is used advisedly for it is well known that the difference of phase, when that alone occurs, is a very important factor.[1]

If the experimental results presented in Fig. 3 are plotted with the logarithms of relative intensities as abscissæ, the results are as shown in the accompanying Fig. 4.

Clearly the mean is best represented by a straight line. This leads at once to the interesting conclusion that the angular displacement, θ, can be expressed in terms of the right and left intensities, I_r and I_e respectively, in the following equation.

$$\theta = \mathrm{K} \log \frac{\mathrm{I}_r}{\mathrm{I}_e}, \qquad (1)$$

where K is a constant.

Before discussing the significance of this law, a record should be made of all the observations in our experiments. There were three observers, and each took a set of observations similar to that shown in Fig. 4. Also each took a set of observations with the non-contact binaurals as shown in Fig. 2. All the observations amply verified (1), but the slope of the non-contact-binaural-curve was generally slightly different, with one observer less and with another greater. Curves indicating the results obtained by one observer are shown in Fig. 5.

Here the slopes of the three full-line curves are 0.81, 0.91 and 0.75, averaging 0.82. The slope of the dotted line, or the non-contact binaural, is 0.63. The results with the non-contact binaurals show an even greater insensitiveness to changes of intensity at the ears and hence the contact binaurals do not lead to incorrect conclusions because of the closing of the external meatus. From the dotted line in Fig. 5, we find the ratio of intensities required to cause a displacement of 45° is approximately 25 to 1.

The results obtained with the other two observers were

[1] See references given by Stewart, *Phys. Rev.*, Second Series, 1917, 9, p. 502.

similar. The average slopes of the contact binaural curves were 0.96 for one and 0.93 for the other observer.

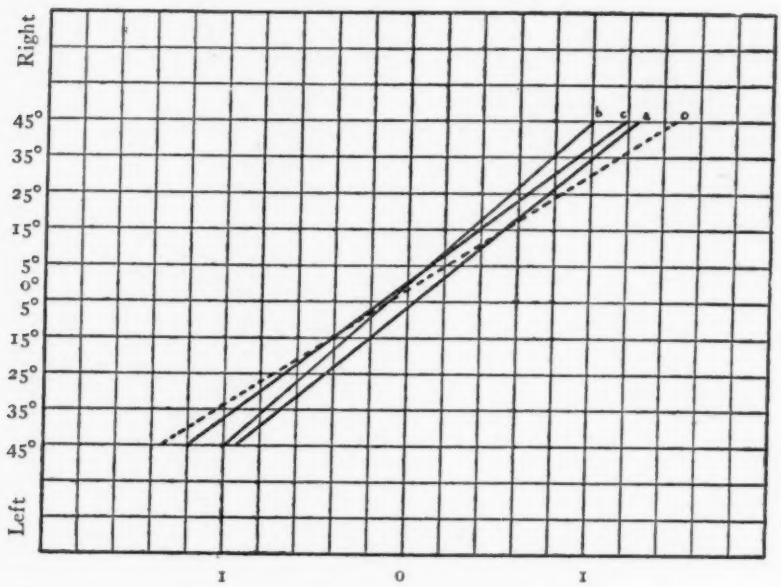

FIG. 5. Log of relative intensities.

In the experiments evidence was found that under certain circumstances the results might be best represented by two straight lines meeting at approximately 0° on the chart. These unusual results will not be discussed in this paper for it is believed that the results already shown represent the normal case.

Equation (1) reminds the reader of Weber's law. In its integrated form it states that the response is proportional to the logarithm of the stimulus. Its apparent truth is found in experiments on vision, audition, pressure, smell, and kinæsthetic complexes, indicates that the law is one of the nervous system and is not dependent upon the nature of the peripheral organs. The discovery expressed in (1) is, however, an interesting and perhaps an important extension of Weber's law, for here we find that the response of the individual as indicated by the constructive angular displacement

is proportional to the logarithm not of one stimulus, but of the ratio of the two stimuli. The above results open up many questions of interest both to the physicist and to the psychologist. The experimental work must be extended until the importance of intensity and phase relations, both singly and together, both with simple and complex tones and for all frequencies is clearly understood.

THE MENTAL INDICES OF SIBLINGS

BY RUDOLF PINTNER

Ohio State University

In the course of giving group tests to a large number of children the writer had the opportunity to compare the performances of many groups of brothers and sisters. The six tests used were (1) Rote Memory Test for concrete words; (2) Digit-Symbol Test; (3) Symbol-Digit Test; (4) Word Building; (5) Easy Opposites; (6) Cancellation. The results obtained with this group of tests, the percentiles for each age and the method of calculating the mental index of each child have been described elsewhere[1] and need not be repeated here.

Out of a great number of grade-school children tested 180 families, of which two children had been tested, and 37 families of three children were found. There were only about five families of four children and these have not been considered. The families of which two or three children have been tested will be dealt with here. A mental index of 50 denotes average ability for any age. Indices above or below 50 indicate abilities above or below the median ability. Is there a greater similarity between the indices of siblings than those of unrelated children?

The average deviation of the mental indices of a family may be taken as one measure of the resemblance of mental ability. The average deviations for the families of two and three were calculated. These average deviations are compared with the deviations obtained by choosing any individuals at random. In the chance selections the cards of unrelated children were thoroughly mixed and then taken in order. The chance selections compared with the families of three contained, of course, three individuals, and similarly

[1] Pintner, R., 'The Mental Survey.' D. Appleton and Co. 1918.

those compared with the families of two contained two individuals. The children attended two different schools and the schools were treated separately and then combined. The averages of the A.D.'s for the various groups are:

	Families of Three		Chance Selections	
	No. of Cases	Average A.D.	Average A.D.	No. of Cases
School *A*	20	11.1	13.8	20
School *B*	17	12.6	13.4	17
Both schools	37	11.7	16.7	37
			14.9	37
			13.6	37

	Families of Two		Chance Selections	
	No. of Cases	Average A.D.	Average A.D.	No. of Cases
School *A*	91	9.8	11.9	91
School *B*	89	9.9	11.6	89
Both schools	180	9.8	12.0	180
			12.3	180
			11.7	180

In School *A* there were twenty families of three and the average of the average deviations of the twenty groups is 11.1. A chance selection of twenty groups of three unrelated individuals each in the same school gives an average A.D. of 13.8. For the total number of families of three the average A.D. is 11.7 and this is compared with three different chance selections each of 37 groups of three unrelated children. In the same way the 180 families of two are compared with three chance selections each of 180 groups of two unrelated children.

It will be seen that the A.D.'s of the siblings are smaller than those of unrelated children. The difference is, to be sure, not very great, but it is present in each school and both in regard to the families of two as well as to the families of three. The average A.D.'s of the chance selections are remarkably similar to each other, and this fact, taken in conjunction with the number of chance selections calculated, seems to show pretty conclusively that the greater resemblance of the mental indices of siblings is not due to chance. At the same time this resemblance is not very marked.

There are many families in which the mental indices of the children differ widely. The largest A.D. for any pair calculated was for a pair of siblings, one of which was feeble-minded and the other slightly above average.

In another treatment of the same data, Yule's[1] association coefficient,

$$Q = \frac{(AB)\ (\alpha\beta) - (A\beta)\ (\alpha B)}{(AB)\ (\alpha\beta) - (A\beta)\ (\alpha B)},$$

using above and below an index of 50 as the dividing line, was used. This coefficient has been calculated for the 180 families of two and for various chance selections with the following results:

	Q	n
School *A*	.47	91
School *B*	.28	89
Both schools	.39	180
Chance selection of sibs	.09	180
Chance selection of sibs	.14	222
Chance selection of unrelated children	.14	151
Chance selection of unrelated children	.19	300

The chance selection of siblings means that the mental indices of the siblings were used, but no two siblings were ever paired. The chance selection of unrelated children excludes the mental indices of the siblings. Here again we note that the coefficient for the siblings is considerably higher than that obtained by any of the chance selections.

The above facts may also be expressed in this manner. There were 114 pairs of siblings, or 63 per cent., in which both members of a pair had a mental index above 50 or both below 50; and there were 66 pairs, or 37 per cent., in which one member had an index above and the other an index below 50. In a chance selection of 180 unrelated pairs (using the indices of the siblings) 99 pairs, or 55 per cent., had both members either above or both below 50; and there were 81 pairs, or 45 per cent., in which one member was above and one below 50.

The Pearson coefficient for the 180 pairs of siblings is $r = .22$, with a P.E. of .02. This correlation is slightly

[1] Yule, G. Udny, 'An Introduction to the Theory of Statistics,' 1916, p. 38.

lower than those obtained by Thorndike for three single tests, namely 29, 30 and 32. Earle's coefficients for spelling ability ranged from .22 to .50. It is much smaller than that obtained by Peters for memory, namely $r = .36$. In the same way the association coefficient of $Q = .39$ for our siblings is smaller than the coefficient of $Q = .53$ obtained by Peters for school grades.

On the whole the general intelligence of siblings is more nearly alike than the general intelligence of unrelated children selected by chance. This greater resemblance is unquestionably due to inheritance, for we are not here dealing with activities that are much influenced by school training. A larger number of tests and a better technique than the group-test method would undoubtedly have shown a greater resemblance, but the resemblance of the mentality of siblings is clearly present, and we have found it even by means of our rough survey tests.

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